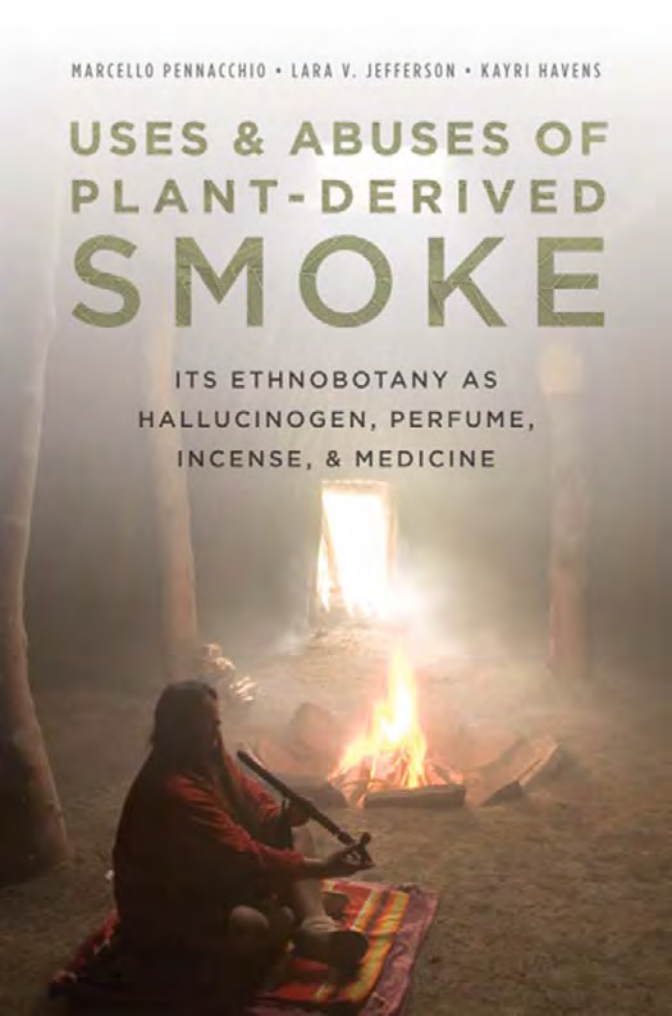
MARCELLO PENNACCHIO • LARA V. JEFFERSON • KAYRI HAVENS

USES & ABUSES OF PLANT-DERIVED SMOKE

ITS ETHNOBOTANY AS HALLUCINOGEN, PERFUME, INCENSE, & MEDICINE



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Marcello Pennacchio / Lara Vanessa Jefferson / Kayri Havens

Illustrations by David S. Sollenberger

OXFORD
UNIVERSITY PRESS
2010

OXFORD
UNIVERSITY PRESS

Oxford University Press, Inc., publishes works that further
Oxford University's objective of excellence
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Oxford New York
Auckland Cape Town Dar es Salaam Hong Kong Karachi
Kuala Lumpur Madrid Melbourne Mexico City Nairobi
New Delhi Shanghai Taipei Toronto

With offices in
Argentina Austria Brazil Chile Czech Republic France Greece
Guatemala Hungary Italy Japan Poland Portugal Singapore
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Published by Oxford University Press, Inc.
198 Madison Avenue, New York, New York 10016

www.oup.com

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This book provides scientific, historical, and cultural information on natural products produced by plants.
The book is not intended as a guide to the preparation and use of these substances. The recreational and other
use of the plants and their products described in the book are often illegal, dangerous, and strongly discouraged.

Library of Congress Cataloging-in-Publication Data
Pennacchio, Marcello.
Uses and abuses of plant-derived smoke : its ethnobotany as hallucinogen,
perfume, incense, and medicine / Marcello Pennacchio, Lara Vanessa Jefferson, and Kayri Havens.
p. cm.
Includes index.
ISBN 978-0-19-537001-0
1. Ethnobotany. 2. Smoke.
I. Jefferson, Lara Vanessa. II. Havens, Kayri. III. Title.
GN476.73.P46 2010
581.6'3—dc22 2009038958

1 3 5 7 9 8 6 4 2

Printed in the United States of America
on acid-free paper

To my late nephew, *Michael Gismondi*,
and to my two sons, *Ryan Dharius Pennacchio* and
Aiden Michael Pennacchio (MP).

To my late grandmother, *Winifred Florence Shirra*,
and two sons, *Ryan* and *Aiden* (LVJ).

To *Emma, Sophie, Ryan, Aiden*, and future generations,
with the sincere hope we strike the right balance between protecting
and using plant biodiversity (KH).

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FOREWORD

Plants are essential for human life. They provide the food, shelter, medicines, and biomass necessary for sustainable livelihoods. Virtually all of our food comes directly or indirectly from plants. More than three-quarters of the world's people use plants as their primary source of medicine. Plants form the framework and productive base of most natural communities, thus protecting watersheds and topsoil and maintaining our atmosphere. They sequester carbon, a factor of increasing importance as carbon dioxide contributes to global climate change. Plants also enhance our daily lives through their beauty and symbolism. We achieved our present levels of civilization following a history of millions of years among plants and depending on them.

Aside from food, one of the earliest and often overlooked uses of plants was the production of smoke, dating back to the time of early hominid species. Plant-derived smoke has had an enormous socioeconomic impact throughout human history. Plants have been burned for medicinal and recreational purposes, magico-religious ceremonies, pest control, food preservation and flavoring, and perfumes.

Despite the negativity and health concerns associated with smoking, the use of plant-derived smoke is an important cultural trait that should be documented. More than 1,400 plant species have been used globally for over 2,000 reported uses. This book is easy to read and provides a wealth of information on the uses, and users, of smoke. It contains numerous interesting facts highlighting the importance of plant-derived smoke to humans.

Peter H. Raven, President, *Missouri Botanical Garden, St. Louis, MO*

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PREFACE

Smoking has such a tarnished image these days that it is easy to overlook the enormous socioeconomic impact that all plant-derived smoke has had throughout our history. For countless generations, humans and their earlier ancestors have burned close to 1,500 species of plants specifically for the smoke they produce. Many, like tobacco, cannabis, and jimsonweed, have a long history of use for medicinal or self-indulgent purposes. Others have yielded important resins that have been burned as incense during religious and other ceremonies. Plants that produce and carry hallucinatory substances in smoke have also found use during religious rituals, often helping spiritual guides and shamans to communicate with the spirit world and gods. These are among the oldest known uses for plant-derived smoke. Many other plants were burned to drive away annoying pests and evil spirits or to preserve and flavor foods and other items.

In the past, smokable plants and their substances have been in such high demand that they have diverted the course of history, have given rise to powerful organizations, both legitimate and illegitimate, and have been fiercely fought over in devastating wars. Plants such as these have generated wealth beyond avarice for the people and groups that provide them to the masses. Nowhere is this more evident than in today's world, where products such as tobacco are a major source of revenue to governments and industry alike. One thousand years earlier, it was the resins of straggly bushes—frankincense and myrrh trees—of southern Oman that made humans rich and powerful. Knowledge of the use of these plants is an important culture trait that deserves to be documented and preserved regardless of the negative stereotypes assigned to smoke.

This is the first book of its kind and one that should appeal to botanists, ethno scientists, pharmacologists, anthropologists, historians, theologians, and plant lovers alike. It is unique in that it lists uses that are only possible after plant material has been burned. To our knowledge, few of the plants listed in this book have been studied for novel compounds that arise from the combustion of their parts. A whole new class of compounds quite possibly awaits discovery.

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ACKNOWLEDGMENTS

A book such as this cannot be written without the generous help and support of many people, all of whom we would like to sincerely thank. Deserving special mention is Carol Line, Executive Director of Fernwood Botanical Garden and Nature Preserve in Michigan. Thanks also to Leora Siegel, Director of the Chicago Botanic Garden Library, and all her staff and volunteers for their assistance, and to Christine Giannoni and her staff at the Field Museum Library, Chicago, Illinois. Susan Otto at the Milwaukee Public Museum, Wisconsin, is thanked for assistance with photographs of Native Americans. We thank Fred Keusenkothen and Chris Freeland of the Missouri Botanical Gardens for helping us obtain an image of *Boswellia carteri* from their rare book collection. Libraries in Illinois, Missouri Botanical Gardens, and throughout the United States assisted greatly with interlibrary loans. The editors and staff at Oxford University Press also deserve special mention. They made the entire process of publishing a book a smooth and enjoyable one, always offering friendly and useful advice.

We would also like to acknowledge the enormous contribution that Samuel J. Goldman, a volunteer at the Chicago Botanic Garden, has made to this project. He assisted with research and provided us with valuable editorial advice. Bob Meyer, also a volunteer at Chicago Botanic Garden, was instrumental in helping us with illustrations. The following people are similarly thanked for reading parts or all of the manuscript: Associate Professor Emilio L. Ghisalberti, Chemistry Department, The University of Western Australia; Raymond Wiggers, Lake Forest College, Illinois; Dr. Connie Locher, School of Pharmacy, Curtin University of Technology, Western Australia. Connie is also thanked for translating German texts; Domenico D'Alessandro, President, D'Alessandro & Associates, Inc.; Andrea Kramer, Chicago Botanic Garden; Kristen Kordecki, Chicago Botanic Garden; Mary Stupen, Chicago Botanic Garden; Marley and Michael Sackheim, volunteers at Chicago Botanic Garden.

Thanks to Dr. Peter Babulka for providing valuable information on plant use in Hungary and for translating Hungarian texts. We thank Mary and Andy Barr, Perth, Western Australia, for helping with Australian ethnobotany and photographs. Dr. Erna V. Lukina, also a volunteer at Chicago Botanic Garden, is thanked for translating Russian texts. We thank Dr. Sarah J. Moore of the London School of Hygiene and Tropical Medicine for information on mosquito and insect repellents. Lorraine Wilcox provided us with information and references to moxibustion. Dr. Dorie Reents-Budet, Consulting Curator for Precolumbian Art at the Mint Museums in Charlotte, North Carolina, is thanked for confirming the identity of Tlaloc on the vase in the Balankanche cave and for other useful information. We thank Chris Moerhart of Northwestern University, Evanston, Illinois, for help in obtaining additional references. Susanne

Masi, Chicago Botanic Garden, is thanked for providing us with the photo of *Aster novae-angliae*. We would also like to acknowledge Randy Hetzel for loaning us his books, which got us started on this project, and for some of the photographs.

The following people helped in various ways with the preparation of this book: Dr. Katie Belisle-Iffrig; Ms. Xiu Yuxia (Lily); Judy Cashen, Manager of Volunteer Services; Gail Kushino; Luisa Miller; Boyce Tankersley; Monica Vachlon; Lydia Kupsky; Lori Sollenberger; and Dr. Charlotte Gyllenhaal. We thank our family and friends for supporting us, especially Antonia (Toni), Onorina, Diodato, Danny, and Palmina Pennacchio for helping with photographs. Juan de la Cruz and Ruperto of Ek Balam, Mexico, are thanked for incense information and photographs. Finally, we would like to acknowledge the wonderful and generous support of the staff and members of the Plant Conservation Alliance, especially Ms. Margaret Peggy Olwell.

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USES AND ABUSES OF PLANT-DERIVED SMOKE

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INTRODUCTION

Fire and Smoke

Where there is smoke, there is fire.—Anon

Fire has played a dominant role in the development of this planet (Pyne 2001). During its approximately 400-million-year reign on Earth, it has radically altered the global landscape and affected many of the organisms that exist on it. Especially affected are the plants that provide it with the very fuel and oxygen it needs to survive. Where fires are a common occurrence, there have been wholesale changes to the structure of the local communities. Fire-prone ecosystems tend to be dominated by plant types that are resistant to its effects or are dependent on it for their existence. Nowhere is this more apparent than in grassland ecosystems, where trees rarely survive fires, allowing the grasses that do survive to dominate the vegetation (Vogl 1974).

Equally significant is the association that humans have formed with fire. By providing us with a source of light and a means to keep warm, it has allowed us to colonize land on every corner of the planet. This in turn may have facilitated fire's own spread to places where it would not have occurred naturally. Throughout the millennia, it has enabled us to explore new foods and diets and therefore may have played a role in our own evolution and development. In more recent times, we have learned how to use fire to tap into the vast reservoirs of energy that are locked up in organisms that perished long ago. The effect that this has had on our technological advancement has been phenomenal, making it possible for us to reach for the skies and beyond. Ironically, the abuse of fire now also threatens the very existence of some of the life on Earth. The huge, dark plumes of smog that hang ominously over many of our large cities are a major cause of pollution and concern. If left unaddressed, it will most likely continue to contribute to the decline and loss of biodiversity on Earth (Wilson 1999).

Fire also possesses the ability to liberate many of the fragrant and therapeutic chemical agents that are locked up in the plants and other organisms that it so readily consumes. These substances, the vast majority of which are secondary metabolites, have provided us with many economically and socially important products. These chemicals, often lacking clearly defined roles in nature, have found their way into our medicine cabinets, meditation rooms, and onto supermarket shelves. This has generated enormous revenues for governments and industry alike and has provided many cultures with a variety of tools with which to survive. It is almost impossible to begin to estimate the enormous socioeconomic impact that some of these natural products have had on our way of life. Frankincense and myrrh, for example, once commanded

such high prices that their value may have at one stage exceeded that of gold. These commodities alone probably accrued more wealth for the Arabian people in ancient times than oil does today (Roberts 1998).

Despite what is already known about the natural products released during the combustion of plant materials, it is not yet clear when humans first started burning plants specifically for these purposes. The very nature of smoke and its uses almost entirely preclude them from the kind of preservation necessary to determine their place in our history. It is not unreasonable to propose, however, that the human use of plant-derived smoke probably commenced shortly after our ancestors learned how to make and control fire. Hominid species, such as *Homo erectus,* had already mastered this art (Kempe 1988). These early humans used fire to warm their caves, provide light, cook their food, and no doubt, to produce smoke that kept annoying insects and other pests at bay. The use of plant-derived smoke may therefore date back 1.6 million years or more. Since its inception, 1,460 plant taxa with 2,383 ethnobotanical uses from 125 countries have been reported and are included in this book. There are likely more.

It is not possible, in a survey of this type, to produce a complete or exhaustive list of all the plants used by humans. The relevant information is not always readily accessible. Occasionally, ethnobotanical surveys have been reported in ancient texts, as well as in research theses, conference proceedings, and local journals. Adding to the problem, some of the information may be reported in a foreign language and has to be translated, adding to the cost and time needed to gather it. Fortunately, the Internet has improved and sped up the way we collect data. With its powerful search engines, it enables researchers to sift through thousands of journals and theses that would once have required visiting several libraries. Furthermore, a number of ancient texts have been digitized and can now be downloaded from appropriate Web sites. Many of those in foreign languages have been translated and can also be accessed through the Net.

Another excellent source of information is the interlibrary loan (ILL) system. The ILL is part of the Online Computer Library Center (OCLC), in which more than 71,000 libraries in 112 countries have agreed to share their resources and make them available to their users (see www.oclc.org/us/en/default.htm). Through it, we were able to obtain hundreds of journal articles, books, and conference proceedings. This can, in many cases, incur a cost, which may or may not be covered by the researchers' libraries. The authors of this book were also able to access a number of relevant journal articles through JSTORE (for more information, see www.jstor.org) and Google Books. Information obtained through the latter was usually tracked down using interlibrary loans. Some books were purchased.

Furthermore, it is not always possible to verify the information reported in the literature. In those cases, it was assumed that the information reported was correct. For example, one of the assumptions we often made was that the plants mentioned in the surveys were correctly identified. Plant identifications are usually conducted in the field by ethnobotanists and other researchers and later confirmed by appropriate authorities and taxonomists. Often, researchers will deposit a voucher specimen in a local herbarium so that other interested parties can check it.

The competence of the people conducting the ethnobotanical surveys in the field is also an important consideration. Did they witness the use of the plants themselves, or was the information collected through interviews? In the latter case, did they ask the right questions, and did they consult the right person or persons? Did the researchers perform a long-term study, in which they may have either lived or worked

in the community, or did they carry out a quick survey? Furthermore, did the holders of traditional knowledge disclose any or all the relevant information, such as part of plant used and dose? Native Australian medical practitioners, for example, are usually reluctant to share their knowledge until they have established a good working rapport with the researchers (Barr, personal communication). Even once the friendship has been established, not all information will be provided. It is also possible, in some cases, for the traditional practitioners to give false or misleading information just to rid themselves of an annoying researcher. Wherever possible, the information should be checked, but this is often an onerous and difficult task. We contacted several authors of articles and books for additional information, especially when clarification on some aspects of their studies or verification of their claims was required. Once the information has been gathered, it is assumed that the researchers have performed the correct statistical analyses and that reviewers for the publishers have checked this. This is usually the practice of reputable journals, books, and conferences. A number of texts are available describing how to conduct ethnobotanical surveys correctly.

Medicinal Uses for Plant-Derived Smoke

The medicinal applications for plant-derived smoke outnumber all other uses. Humans have been using medicinal plants for tens of thousands of years, many of which still form an integral part of the health-care systems of developing countries. In the developed world, most of the pharmaceutical agents available today are either directly extracted from plants or are synthetic analogues structurally derived from natural products. These agents have prevented illness, have saved the lives of millions of people, have been used in medical diagnoses, and have significantly increased our life expectancies. The demand for pharmaceutical agents and herbal treatments is so great that it has spawned multibillion-dollar industries that employ millions of people worldwide. A significant number of medicinal products are undocumented historically and are likely to be lost when holders of traditional knowledge pass away.

Most of the information that has been recorded has appeared in pharmacopoeias, *materiae medicae,* ethnobotanical texts, journal articles, and conference proceedings. Where smokable plants are concerned, 1,002 medicinal uses have been reported throughout the world for more than 737 plants (table 1). So broad is the spectrum of use that nearly every organ or system of the human body has been medicated in one form or another with plant-derived smoke. Fumigations were used to treat wounds, cleanse the skin, and help with the birth and postpartum care of newborn babies and their mothers. Native Australians were among the best-known practitioners for this latter use (Barr 1993), but it has also been reported in India (Kaul and Atal 1983), North America (Krochmal and Krochmal 1973), South America (Macía et al. 2005), and Africa (Neuwinger 1994; Dlisani and Bhat 1999).

Indigenous Australians have traditionally employed plant-derived smoke to strengthen babies and mothers during and immediately following childbirth. Typically, a warm bed of ashes was laid on the ground on which various plants were smoldered. All newborn babies were passed through the fragrant smoke arising from the ash bed (figure 1). This reportedly protected them from evil and gave them spiritual strength (Levitt 1981). Species, such as the Cooktown ironwood, *Erythrophleum chlorostachys,* were routinely burned in the maternity areas of Native Australian camps. The smoke of several other species, including acacias and eremophilas, were also inhaled to induce lactation and to stem the flow of postpartum bleeding in some cases (Barr 1993).

Table 1. Ethnobotanical and ecological uses for plant-derived smoke.

Categories of Use	Uses Reported	Total Plants Used
Medicinal	1,002	737
Magico-religious and ceremonial	571	399
Recreational	267	156
Pest control	184	165
Perfumes	64	61
Flavoring and preservation	178	132
Toxic or obnoxious	56	53
Veterinary	35	32
No specified use	59	46

Note: Many of the plant species have multiple uses, and so totaling the number of plants for each category of use will result in 1,781 taxa, which is higher than the actual total of 1,460. The same applies to the number of uses. The last category, No specified use, lists all those plants in which the use for their smoke was not described. See Unspecified Uses near the end of the Introduction.

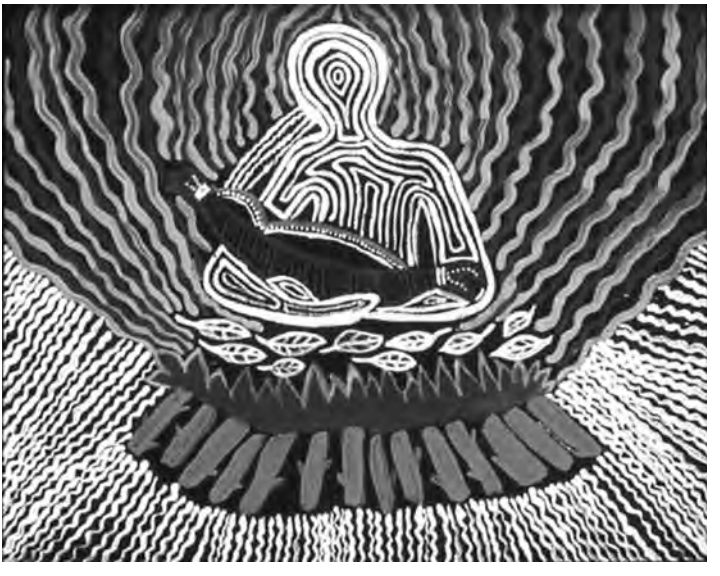

Figure 1. Indigenous Australians often used plant-derived smoke to strengthen newborn babies and their mothers. "Welcoming the Newborn" by Patricia Marrfurra McTaggart from the Nauiyu Community (Daly River, Australia). Photograph courtesy of Mary and Andy Barr.

Smoke treatments such as these have also found use for terminating pregnancies. A number of polyherbal recipes with abortifacient properties were reported, with cannabis (*Cannabis sativa;* Merzouki et al. 2000) and maize (*Zea mays;* Gémes 1987) among the more interesting ingredients. Other recipes required the addition of poison hemlock (*Conium maculatum*), a plant commonly known for its toxic effects. Perhaps equally as fascinating is the burning of onion (*Allium cepa*) and pigeon feces to induce abortion through vaginal fumigations, as listed in ancient Indian Ayurveda texts (Venkataraghavan and Sundaresan 1981). In Hungary, a related bulb, garlic

(*Allium sativum*), was burned with pig feces to produce smoke that was used to calm frightened children (Oláh 1987).

Although many of the medicinal uses for plant-derived smoke were external, most were specifically for internal use. The inhalation of smoke is a rapid and effective means to introduce secondary plant metabolites and other chemicals into the body. The large surface area of the lungs, equivalent to that of a tennis court (140 m^2), along with its highly vascular alveoli, provides almost instant access to the blood and to the very organs responsible for breathing in the smoke. Once absorbed into the bloodstream, active substances in the smoke are rapidly dispersed throughout the body, mediating their effects almost instantly in some cases. Problems with the digestive system and muscles have all been treated with smoke, as have fevers, rheumatism, inflammation, and other afflictions of the immune system. Several plants, when burned, emit analgesic substances, making them ideal for use as painkillers. Smoke remedies for earache, backache, and toothache were common. The greatest use for smoke analgesics was, however, for the relief of headaches. Approximately 100 species were used for this purpose alone.

Another analgesic species that has received more than its fair share of the limelight is hemp, or *Cannabis sativa*. Cannabis is best known for its psychoactive properties, but it is also highly regarded as a medicinal agent. Traditionally, it was used as a medicament for various illnesses. Approximately 100 medicinal uses were listed in Chinese pharmacopoeias that date as far back as 5,000 years to Emperor Shên-Nung (Russo 1998). Similar documents have revealed that the medicinal use of cannabis was also once common in India, Egypt, Assyria, ancient Israel, Palestine, Judea, Greece, and Rome. Its analgesic properties are due to a variety of resins called *cannabinoids* (Meng et al. 1998). These compounds, especially Δ^9-tetrahydrocannabinol (Δ^9-THC), which was first isolated in 1964 (Gaoni and Mechoulam 1964), are also responsible for the psychoactive properties of the species. Today, cannabis leaves and flowers are smoked recreationally throughout the world and increasingly for their medicinal applications.

Almost one-third of the 1,002 medicinal uses for plant-derived smoke were prescriptions for respiratory disorders. The respiratory system is almost always affected by smoke. Over time, this annoyance to humans probably led to the serendipitous discovery of many respiratory-related cures. Coughs, colds, influenza, catarrh, nasal congestion, and tuberculosis were among the many illnesses treated with plant-derived smoke. However, one of its more significant uses was for the relief of asthma, a serious respiratory condition that affects millions of people from all strata of the world's population. The financial burden and personal hardship that this has imposed on health-care systems, sufferers, and their families are considered greater than that of tuberculosis and HIV/AIDS combined. Traditionally, one of the more widely smoked plants for the relief of asthma was the jimsonweed, *Datura stramonium* (see page 82).

Jimsonweed has a long history of global use ranging from providing relief to sufferers of asthma and other respiratory ailments to dulling the senses of people sacrificed during ceremonial executions. Hallucinations are also common, including colored visions and Lilliputian images, which are reported by 83% of all users (Ellenhorn and Barceloux 1988). Medicine men and women have known about its psychoactive properties for centuries (Krochmal and Krochmal 1973). However, it was not until the 1960s that its popularity as an hallucinogen gained momentum in mainstream society and that many deaths were reported after its use. Jimsonweed has traditionally

also served as an essential ingredient in a variety of witchcraft recipes that induce feelings of flight and other surreal sensations. The modern-day concept of witches riding brooms may have derived from those feelings. According to anecdotal stories, it could also have originated following the use of broom handles to apply vaginal salves prepared from various *Datura* species.

Datura stramonium was one of the more commonly used *Datura* species. This annual herb grows along roadsides and pastures and in waste areas. Its country of origin has long been the subject of debate. Notable botanical writers, such as Alphonse de Candolle (DC.) in his *Géographie Botanique* of 1855, suggested that the species was indigenous to the Old World. Thomas Nuttall (Nutt.), in contrast, suggested that South America or Asia was its more likely center of origin. In more recent times, Symon and Haegi (1991) have reported that jimsonweed is a New World plant that probably originated in Mexico and has, since circa the 1700s, slowly migrated north (Warwick 1990) into North America, where it is now a naturalized and noxious weed. Its spread into Europe is thought to have occurred sometime around the first century A.D., when datura-smoking Roma people introduced it there.

Also uncertain is the origins of the species epiphet, *stramonium*. The generic name was derived from the Hindu word *dhatura,* which itself was from the Sanskrit word for the Indian species *Datura fastuosa,* d'hastura. The common or vernacular name, jimsonweed, is believed to be a corruption of the name of the small U.S. Virginia town Jamestown. In 1676, a detachment of British troops was sent to the town to quell a rebellion known as Bacon's Rebellion. In 1705, a Virginian farmer, Robert Beverly, writing about the slave society that was emerging in Virginia at the start of the eighteenth century, commented that some of the soldiers sent to quell the rebellion added jimsonweed leaves to their salad (Beverly 1705). He claimed that they went crazy for 11 days, sparing the folks at Jamestown any punishment. Several centuries earlier, Mark Anthony's troops may also have suffered a similar fate, falling victim to this or a closely related species.

Datura use has been reported all over the world but was especially important in India, where it was considered a sacred plant to the Hindu god Shiva Nataraja (figure 2). The sculpture depicting the icon is one of India's best-known works of art and most recognized images (Kaimal 1999). In the sculpture, the four-armed Shiva is performing a dance in a ring of fire. Below Shiva's foot is the dwarf of ignorance, Apasmara. Nestled in Shiva's hair is the goddess Ganja, who is a personification of the Ganges River. Also among the locks of hair are a crescent moon and a datura blossom. The smoking of jimsonweed and other *Datura* species for the relief of asthma is believed to have originated in the East Indies and from there was spread throughout Europe and beyond by an English army general.

Datura leaves are usually rolled into cigarettes or smoked in a pipe. Many of the compounds produced by these species are toxic, therefore restricting their use. Chief among these are the tropane alkaloids, hyoscyamine, hyoscine, atropine (D, L-hyoscyamine), and scopolamine (L-hyoscine) (Ellenhorn and Barceloux 1988; Lewis and Elvin-Lewis 2003). These have been referred to as mydriatic alkaloids because they cause the pupils of the eyes to dilate (Leete 1959). Asthma-relieving properties are due to atropine, which paralyzes the pulmonary branches of the lungs, eliminating spasms produced during asthma attacks. These effects are palliative in nature and therefore only treat symptoms of asthma without leading to a cure.

Figure 2. Datura was considered a sacred plant to the Hindu people and their god Shiva Nataraja. The flower of a *Datura* species appears in the hair of the god, who represents both creation and destruction. The leaves of the plants were rolled into cigarettes or smoked in pipes.

Low doses of alkaloids are usually absorbed by smoking *Datura* species but are considered extremely dangerous nevertheless. The medical literature abounds with reports of deliberate or inadvertent poisonings resulting from smoking jimsonweed and other related species (Lewis and Elvin-Lewis 2003). Accidental poisonings have even occurred as a result of ingesting honey made from *Datura* species (Ramirez et al. 1999). Most poisonings occur, however, in teenagers who explore the mind-altering properties of the smoke. Symptoms of poisoning include mydriasis, cyclopegia, dry skin, dry mouth, urinary retention, tachycardia, delirium, and respiratory arrest (Winchester 1990). The onset of these symptoms usually occurs within 30 to 60 minutes of smoking the plants (Gilman 1990). Effects can last from 24 to 48 hours but have been known to persist for up to 2 weeks (Gilman 1990). The lethal nature of these compounds has thus resulted in worldwide smoking bans for jimsonweed and related species and is thus not recommended here.

Purification

Although many plants were smoked to treat human illnesses, others have served as disinfectants and purifying agents to remove illnesses from human surroundings or prevent them from becoming established there. This is an ancient practice whose origins have long since faded from human memories. Early records of ancient Egyptian disinfectants include frankincense, myrrh, and cinnamon bark (Manniche 1989), all of which are still used today. Several species were used in this capacity throughout the world. However, none are historically more important and better known than the fumigations reported from Athens circa 400 B.C.

During the 27-year period from 431 to 404 B.C., Greece's capital was under siege by two enemies. Sparta, Corinth, and other members of the Peloponnesian Confederacy had waged war against Athens, killing many of its citizens in the bloody battles that ensued. Those who managed to survive the war lived only to face an even greater horror. With little or no regard for rank, sex, race, or religion, a mysterious plague threatened Athens, exposing the entire populace to risk. Among the many it killed was the great Greek statesman Pericles. Were it not for Athens's medical fraternity, the death toll may have been even higher.

Despite detailed accounts of the plague by the renowned Greek historian Thucydides, medical historians have yet to identify the agent responsible for the epidemic. To this day, no known diseases fit the descriptions in Thucydides' writings. Smallpox and typhus have both been suggested, but there is still much debate and speculation (Retief and Cilliers 1998). Even less certain is the identity of the individual who freed Athens from the clutches of its epidemic. For centuries, the man most directly accredited for the city's salvation was Hippocrates of Cos (460–377 B.C.), the man many consider the father of modern medicine. Notable historians and physicians, including Pliny the Elder of Como (A.D. 23–79), Galen of Pergamum (A.D. 130–201), and Aetius of Amida (A.D. 502–575), all reported that Hippocrates lit large bonfires in the streets of Athens to purify the unhealthy air, or miasma, that existed in the city at that time (Pinault 1986). Juniper berries (*Juniperus* sp.) were among several herbal ingredients used to fuel the fires (Milliken and Bridgewater 2004). Interestingly, though, there was no mention of Hippocrates in any of Thucydides' works, throwing into question his role in Athens's salvation (Pinault 1986). Acron may have ordered the fires according to Oribasius of Pergamum (A.D. 320–400).

At least 27 junipers were burned for the use of their smoke, making this genus one of the most widely used for that purpose. This is not surprising given the widespread and abundant distribution of the genus. The common juniper (*J. communis*), for example, has the largest northern circumpolar distribution of any conifer, extending further into the northern biotic zone than all others (Rousseau 1974). Smoke-related uses for this and other junipers range from airing out sickrooms, treating colds, adding flavor to food, perfuming houses and other items, driving away annoying insects, assisting with childbirth, acting as tonics that gave people greater endurance, and driving away evil. In parts of Italy, juniper smoke was regularly burned to keep evil at bay (Pieroni and Giusti 2002). Evil-deterring smoke treatments such as these often prevented or cured a variety of illnesses as well. Evil and illness are so intimately intertwined in some cultures that there is often no clear distinction between the two.

Evil and Medicine

The concept of evil has been acknowledged in one form or another in all parts of the world. Throughout human history, belief in the supernatural has had a profound effect on almost every civilization, resulting in a variety of practices to avert its harmful powers. Demons and other evil entities feature prominently in early and contemporary literature, but it is often the evil eye that is considered the most devastating of all. Its presence is universal with no spatial or temporal boundaries. It has been reported in Westernized and non-Westernized countries as well as in ancient cultures, including Babylon, Egypt, Rome, Greece, India, China, and in parts of Africa (Lykiardopolous 1981). Its powers are potentially so harmful that they are usually considered outside the sphere of normal human control and may require extraordinary measures to stave off or diminish its effects. Symptoms of possession or attack include nausea, vomiting, diarrhea, fever, weight loss, and insomnia, all of which have been treated with some type of plant-derived smoke.

Regardless of its many forms or reasons for existing, we do not yet understand why humans are so vulnerable to evil. To combat evil, we carry a variety of charms, amulets, and other material objects. And of course, we burn and smoke plants. This is a common practice, with the smoke from at least 60 plant species forming the linchpin of treatments meant to protect humans from evil. In the Andes Mountains of South

America, for example, mothers protect their infants from the evil eye, or *mal de ojo,* by using amulets and tobacco smoke (Mizrach 1994). Elsewhere, other potentially harmful plants, like the castor-oil tree (*Ricinus communis*), have served in this role.

The mechanisms by which smoke is able to avert the effects of evil are as poorly understood as are its reasons for existing. Many cultures believe that the smoke of some plants is offensive or harmful to evil spirits. This could explain why poisonous or potentially toxic plants like the castor-oil tree or chili plants were used, but it does not reveal how the smoke deters these entities. Smoke's disinfectant properties and ability to eliminate disease-causing agents may also offer some explanation. By killing potentially pathogenic organisms, smoke could give the impression that it has countered the effects of evil. This could explain why children, who have less developed immune systems and who are more vulnerable to evil according to many cultures, have often been the targets for smoke treatments. Interestingly, the Chorti Maya of Guatemala used plant-derived smoke to drive away the evil and the illnesses it causes from the carcasses of the animals that they hunted and ate (Wisdom 1940). Perhaps antiseptic compounds suspended in the smoke sterilized the meat, killing the very pathogenic organisms that made them ill in the first place.

Magico-Religious and Ceremonial Uses

In tiny communities scattered throughout the Karakoram Mountains of Pakistan, Hanzakut shamans, called *bitans,* go into juniper smoke-induced trances to help them communicate with supernatural beings. During deliberations with members of the spirit world, they receive advice on how to heal their patients (Sidky 1994). In preparation for these occasions, the bitans inhale the smoke of burning pencil cedars (*Juniperus macropoda*) and drink the blood of freshly decapitated goat heads. These are said to be highly effective measures. In parts of Nicaragua, native healers (*sukyas*), in contrast, smoked large quantities of tobacco (*Nicotiana* spp.) to help them commune with their spirit world (Appel 1977). Once they entered into a trance or hypnotic state, the spirits spoke to them, prescribing several cures or treatments for the sick. Traditional healers have for centuries relied on methods such as these to obtain spiritual advice on how to treat their patients.

Traditional healers also have used hallucinogenic substances to help them foretell the future, but few were as famous or adept at it as the Delphic oracles of ancient Greece. Plants may have been burned in the oracles' presence to produce the *pneuma enthusiastikons,* or hallucinogenic vapors, that helped the priestess commune with gods like Apollo. According to Greek mythology, Apollo, the son of Zeus and Leto, slew a powerful she-dragon at Delphi, a site that still exists to the north of the Gulf of Corinth on Greece's Mt. Parnassos (Rose 1959). To placate the dragon's spirit, Apollo created a powerful shamanistic priestess in her stead, called *Pythia,* whose primary role was to serve as the voice of the young god. Several priestesses, all of whom were virgins born at Delphi, were on hand to petition the gods on behalf of mortals. All of Pythia's mantic sessions were held in a special chamber in Apollo's temple while seated on a tripod that was fastened to the *omphalos*, or "navel" stone. Below the tripod was a small hole through which vapors arose, shrouding the diviner in a dense fog of fumes. Only the priests who served the oracles were permitted entry into their inner sanctum, or *adytum*. In addition to assisting the Pythia, they were responsible for relaying the unintelligible responses of the oracle to mortal inquirers. These were usually in a verse form known as hexameters (Rose 1959).

Various researches have suggested that visions seen by the Pythia during her divinations may have been caused by a variety of potentially toxic natural gases escaping from fissures in the ground. These include light hydrocarbons, such as ethylene and ethane, which have been used as anesthetics and known to produce similar visions to those reported by the oracles (Spiller et al. 2002). Fumigations from several known hallucinogenic plants have also been implicated. These may have been burned below the mantic chamber (*manteion*), with the fumes vented up through the hole to the Pythia whenever she was called on to commune with the gods. Several hallucinogenic plants, including white henbane (*Hyoscyamus albus*), jimsonweed (*Datura stramonium*), mandragora (*Atropa mandragora*), and hemp (*Cannabis sativa*), have all been suggested as likely sources for the smoke-based hallucinogens (Stefanis et al. 1975; Rätsch 1987). Another possible herbal source for the visions was the laurel tree (probably *Laurus nobilis*), apparently a favorite of Apollo. The Pythia may have fumigated herself with its smoke or chewed its leaves prior to her divinations (Littleton 1986). At the very least, these would have prepared her for her inquiries.

The use of plant-derived smoke for magico-religious and ceremonial uses such as these is its second largest category of use and almost certainly one of its oldest (table 1). Its origins probably date back to when religious beliefs and fire commenced routinely coexisting with humans. To early humans, the sight of smoke slowly spiraling toward the heavens must have given it important religious significance, especially if it induced psychedelic hallucinations. Prayers were carried aloft to the gods on fumes from humans' fires, petitioning them for favors and protection. To this end, Native Americans burned the leaves of *Hierochloe odorata* to summon guardian spirits that protected members of their tribes from thunder and lightning (Foster and Hobbs 2002). In Africa, the Pokot of northern Kenya believed that the smoke of burning *Maerua subcordata* leaves could prevent and stop earthquakes (Timberlake 1987). In South Africa, the Zulu fanned plant-derived smoke over their plant fields, believing it was a fertility charm that promoted better yields in the subsequent season's crops (Hutchings et al. 1996). The use of smoke to promote germination was observed elsewhere, including in North America during the 1600s and in several contemporary ecosystems.

Incense

Plant materials burned for magico-religious and similar purposes are often referred to as *incense*—a word meaning "to set on fire." Incense use is an ancient practice that is widespread throughout the world. In traditional Buddhist rituals, for example, the burning of plant materials for their fragrant smoke is used to accompany meditations, for heightening self-awareness, and for freeing oneself from negative states of mind. In other cultures, it is used to accompany prayer, to worship gods, to purify and perfume the air, and also to release negative vibrations, or "vibes." Incense reportedly can uplift the emotional state, ward off evil spirits, induce trances, and invoke the goodwill of ancestors. Other religions, including the Catholic Church, routinely burn incense during important ceremonies (figure 3). Given such an extensive repertoire of uses, most of the plants listed in this compendium could quite easily be classified as incense materials, and almost 400 are. These were all reported as incense in original texts and have similarly been reported as such here.

In its broadest sense, incense is any material that is burned or volatilized to emit fragrant fumes (Groom 1981). Narrower meanings refer to incense as frankincense and myrrh, or just frankincense, but will not be used in that way here. Records of

incense use began appearing approximately 5,000 to 6,000 years ago (Gilman and Xun 2004). Ancient cultures, such as the Sumerians, Babylonians, Egyptians, Assyrians, Romans, Greeks, Hebrews, Persians, and Parthians (an ancient civilization probably of northern Iran), all used incense at one time or another throughout their history (Groom 1981). The ancient Romans and Greeks were especially fond of this practice and burned vast quantities of incense materials, especially frankincense and myrrh. The Roman Emperor Nero is said to have lavishly burned 1 year's supply in just 1 day to mourn the death of his second wife, Poppaea Sabina. This was at considerable expense given that the annual Roman shipment of frankincense alone was approximately 7,000 tons (Fiennes 1992).

Figure 3. Incense is frequently burned during Catholic mass and other religious events.

In ancient Egypt, the high priests and pharaohs presided over important ceremonies, offering incense to the gods personally (Cuthbert and Atchley 1909). According to ancient Egyptian legends, frankincense was first brought into Egypt in the talons of a magnificent bird that built its nest from the twigs of the trees (Miller and Morris 1988). This myth later transformed into the legend of the Phoenix bird, a fabulous creature that arose from the ashes of a former life. According to Ovid's *Metamorphoses*, the myrrh tree was once the daughter of King Cinyras of Cyprus (Simpson 2003). Myrrha, who lusted for her own father, deceived the king and incestuously bore him a son. To spare her the wrath of Cinyras, the gods transformed Myrrha into the incense tree.

Demand for frankincense and myrrh in ancient Egypt, Mesopotamia, Greece, Rome, India, and China gave rise to an economically important incense trade that, for a millennium or more, generated wealth beyond avarice for many Arabian people. The kings of Hadramawt, where the resins were harvested, profited handsomely from its sale, as did those who transported the cargo and taxed it en route. The farmers who harvested the incense resins received few of the spoils (Groom 1981). Inscriptions on Egypt's Queen Hatchepsut's temple in Thebes, dating back to 1490 B.C., suggest that she sent an expedition to the fabled land of Punt (probably somewhere in Somalia) to bring back incense trees. These were planted at her temple but did not survive the conditions in Egypt (Groom 1981; Miller and Morris 1988). The Romans, also in search of the precious materials, dispatched 10,000 soldiers in an attempt to locate the incense-growing fields and gather the priceless resins for themselves. Disease and rumors of winged serpents doomed the mission before the Romans found the source.

Since then, the Roman naturalist Pliny the Elder has provided us with the most detailed descriptions of the Arabian incense trade. At its height, camel caravans num-

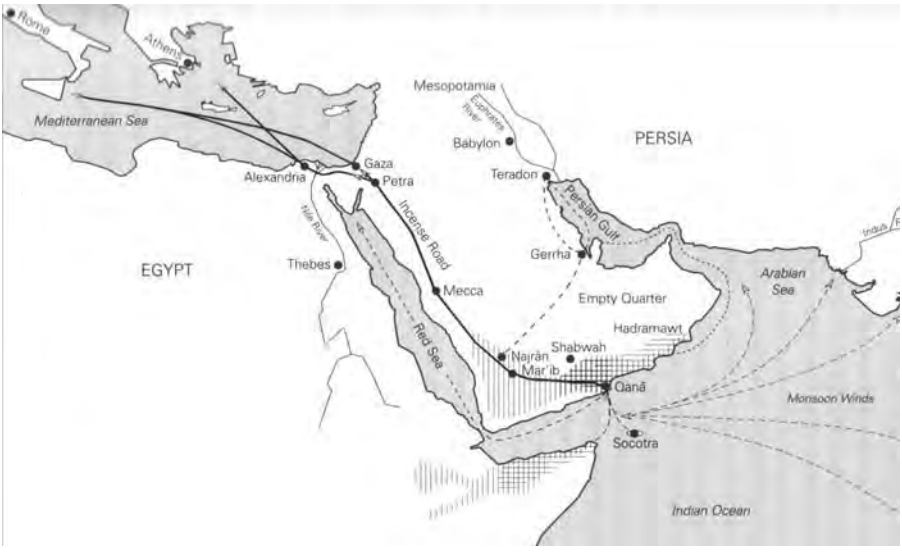

Figure 4. The Arabian incense trail. Adapted from Langenheim (2003).

bering in the thousands of animals transported the precious cargo across Arabia to processing plants in Alexandria, west of Gaza (figure 4). Their incredible journey started in the south of Oman, in Dhofar, and in other nearby regions of Arabia Felix, or Happy Arabia. Conditions there were ideal for the growth of frankincense and myrrh trees. Once harvested, the resins were shipped on boats the short distance from Dhofar to Qana, also in southern Oman. There they returned to land and were loaded on "ships of the desert" (camels) bound for Alexandria. The actual route taken may have changed several times due to bandits, sandstorms, and the imposition of taxes in many of the towns through which the caravans passed.

In Alexandria, the incense was processed prior to being transported to Greece, Rome, and Mesopotamia. Workers at the processing plants were stripped naked at the end of each day and searched for stolen incense. By approximately 24 B.C., incense and other goods were shipped aboard Arabian dhows from southern Oman to Myos Hormos and other Egyptian ports, ending the incense trail and the long caravans that traveled its course. Eventually, the trade itself faded into obscurity. Prior to its demise, the demand for frankincense and myrrh made them among the most precious substances on Earth (Roberts 1998). According to the legend of the three wise men, or Magi (Balthasar, Melchior, and Gaspar), gold, frankincense, and myrrh were so precious they were presented to the Christ child upon his birth (Matthew 2:11). The gold represented the emblem of royalty, and frankincense symbolized divinity. Myrrh was associated with Christ's persecution and death (Groom 1981).

Incense-Producing Plants

Frankincense and myrrh are oleo-gum resins produced by trees of the torchwood family, Burseraceae. There are currently 18 recognized genera in this family, with approximately 700 species in all. The torchwood family is characterized by resin ducts, of which there are many types in various places in plants (Langenheim 2003). Frankincense, also known as *olibanum*, was traditionally less valuable than myrrh but was in greater demand

(Abercrombie 1985). It is produced by several species of *Boswellia*. Most contemporary sources of frankincense include *Boswellia carteri, B. sacra*, and *B. frereana* (Tucker 1986). In ancient times, they were probably harvested from *B. papyrifera*. Myrrh is derived from plants within the genus *Commiphora*. Most of the myrrh used today comes from *Commiphora myrrha,* but in ancient times, it may have been tapped from *C. erythraea*.

Both resin types are harvested from the trunk of the plants after an incision is made in the bark. Professional harvesters allow the resins to harden on the trunk before collecting them some 2 to 3 weeks later. This method for harvesting these resins, first described by the Greek father of botany, Theophrastus (ca. 372–287 B.C.), and later the Greek father of history, Herodotus (ca. 484–425 B.C.), has remained largely the same since ancient times (Groom 1981). In parts of Mexico's Yucatán Peninsula, small fires are lit at the base of resin-yielding trees, forcing the resins up the trunk to a point where an incision or scrape is made. There they ooze out for harvesting. This usually results in larger sized tears. It is not known, however, what effect this has on the trees.

According to the few remaining contemporary professional harvesters of frankincense, the first and second scrapings do not produce useful yields (Abercrombie 1985). It is usually the third that is considered the cash crop. Other plant scientists have already described the chemistry of the frankincense and myrrh resins (see Tucker 1986; Langenheim 2003; Hanuš et al. 2005). In brief, most are complex mixtures of sesquiterpenes. Their pleasant fragrances are due to small quantities of volatile oils, which may comprise up to 17% of the total volume. The familiar odor of myrrh is due to furanosesquiterpenes.

Almost 400 species of plants were reportedly burned for incense purposes throughout the world. In addition to the two aforementioned genera, *Bursera, Canarium,* and *Protium* plants, also of the family Burseraceae, have yielded incense materials. It is interesting to note that all five members of the torchwood family were independently prized for incense resins in three different regions of the world. Frankincense and myrrh were originally used in Arabia. Resins from the genus *Canarium* were burned as incense in the Indian subcontinent and in nearby Southeast Asian countries. Ways to harvest and use the resins may have been learned from their experience with Arabian incense. *Bursera* and *Protium* species, in contrast, were burned as incense in Central and South America. These were often referred to as copal, a name derived from the Aztec Nahuatl word *copalli*.

Evidence for incense use in Mesoamerica can be found among the many ruins of ancient Maya and Aztec civilizations (figure 5). Incense burners, called *censers*, and other important archeological artifacts, for example, were discovered in Mexico's Balankanche Cave (Gruta de Balankanche, which is Mayan for "hidden throne"). This site is approximately 6 km north of the famous tourist destination Chichén-Itzá (figure 6). Incense was often burned in large censers, especially during human sacrifices to the god of rain, Tlaloc (figure 7). Many censers, dating back 800 years, were left surrounding the Balam Throne, a large stalagmite that resembles the ceiba tree. According to the Maya, the ceiba tree is of significant religious importance and has been referred to as the "sacred tree inside the earth." Visiting the Balankanche Cave involves a combination of high temperatures, high humidity, a round trip of 1 km, and knowledge of human sacrifices. Obviously, this is not always a pleasant excursion for all who visit the site.

There is still considerable confusion about the sources and uses of copal in Mesoamerica (Stross 1997). The gums and resins of several genera were used, with *Bursera bipinnata* serving as the prototypical copal. The Maya (figure 8) obtained incense resins from many other plants, including pine trees (Morehart et al. 2005). A variety of

Figure 5. (*top*) Ancient Mayan ruins, like those at Ek Balam, Mexico, were sites where incense was burned in copious amounts.

Figure 6. (*above left*) Incense was burned during religious and other ceremonies throughout Mesoamerica, including Chichén-Itzá in Mexico's Yucatán Peninsula.

Figure 7. (*above*) Incense censers and other important archeological artifacts were discovered in the Balankanche Cave (Gruta de Balankanche), near Chichén-Itzá in Mexico's Yucatán Peninsula. The large vase in the foreground depicts the god of rain, Tlaloc.

Figure 8. (*left*) Traditional Mayan shaman Juan del la Cruz burns copal resin (probably from *Protium copal*) incense during a traditional Mayan wedding that took place in Ek Balam, Mexico (January 2006). Incense was burned throughout Mesoamerica for religious and other purposes.

conifers have similarly found use as sources of incense materials in Mesoamerica and elsewhere. These include members of the Cupressaceae (cypress) and Pinaceae (pine) families. Many incense products were derived from strongly scented plants, such as those of the mint family, Lamiaceae. Other genera include *Agathis, Hymenaea, Jatropha,* and *Rhus* (see the List of Plants chapter; Stross 1997; Case et al. 2003; Langenheim 2003). Given their wide distribution and abundance, it comes as no surprise that the composites (sunflower family, Asteraceae) also featured prominently in incense use. In fact, it is the most widely used family of plants for ethnobotanical smoke purposes.

In the Far East, incense use dates back to the Shang Dynasty of 1600–1030 B.C. and formed an essential part of many religious ceremonies. Some of the more common uses included making offerings to deceased loved ones, driving away evil spirits, and as a symbol of honor to living loved ones. In Java, Indonesia, incense is believed to connect one with spirits of their ancestors and god. Four types of incense are recognized, namely, conical (*gunungan* or mountain), powder (*setangii* in western Java; *ratus* in central and eastern Java), amorphous ("kemenyan"), and the raw form. Several different methods and materials are employed in the making the incense in that country. In Japan, incense is an integral part of the famous koh-do ceremonies and is an art form that can take years to master.

In North America, many species of plants were burned by Native American tribes as good luck charms during hunting expeditions. In some cases, the smoke was considered useful for attracting or luring game to the hunters. Plant species, such as *Ranunculus pensylvanicus* L. f. (Smith 1932) and various *Rumex* species were especially considered useful for this purpose. Also useful for attracting game was *Thalictrum dasycarpum* Fisch. & Avé-Lall. The Potowatomi of North America smoked the seeds of this plant to bring them good luck while hunting (Smith 1933) but also mixed the seeds with tobacco (*Nicotiana* spp.) and smoked the mixture to lure lady friends. In Bulamogi County, Uganda, men smoked various plants to rid themselves of their wives (Tabuti et al. 2003). In other parts of Africa, a variety of plants were smoked to help with criminal cases or to protect people from losing their jobs. A total of 399 plants with 571 reported magico-religious and ceremonial uses from 67 countries are described in the List of Plants chapter.

Recreational Uses

Depending on whom you consult, tobacco is both a blessing and a curse. The negative publicity surrounding cigarette smoking has made it such a socially unacceptable habit in some parts of the world that it is easy to ignore its place in our history. To the Native Americans who discovered tobacco several thousands of years ago, it was a sacred and important plant that had a profound effect on their lives (Brown 1989; figure 9), both positive and negative. Prior to Christopher Columbus setting foot in the Americas in 1492, tobacco use was already widespread and well entrenched in Native American mythology and folklore (Asch 1994). Its use dates back to 2500 B.C. (Pearsall 1992). Tobacco was one of only a few plant species that Native Americans cultivated and used as bartering agents. It was an important component during many important religious ceremonies, meetings, and hunting sessions and was often used in peace pipes as a flag of truce (Carver 1778; Zeisberger 1779). It was also used to drive away evil (figure 10). Moreover, tobacco was considered potent medicine.

Early American colonial almanacs reported that tobacco smoke was a useful remedy for earache and toothache and for relieving convulsions (Wesley 1836). In Louisiana, the

Figure 9. Tobacco (*Nicotiana* spp.) has for millennia been important to Native Americans. In 1941, John Mink, a member of the Ojibwa tribe of Wisconsin, smokes tobacco in a pipe. Photograph by Robert E. Ritzenthaler. Courtesy of Milwaukee Public Museum.

Figure 10. A member of the Potawatomi tribe of the American Midwest blows tobacco smoke over the grave of a family member. Photograph by Robert E. Ritzenthaler. Courtesy of Milwaukee Public Museum.

Choctaw blew its smoke over patients bitten by snakes because it was believed to alleviate the pain and treat the wound (Bushnell 1909). Native North American shamans used it to drive diseases out of their patients (Seig 1999). To settle colicky babies, the Ozarker of the Ozark Plateau in the American Midwest blew tobacco smoke through their milk (Liebert 1987). Tobacco smoke was also widely rumored to provide protection against malaria for plantation slaves (Romans 1962). Many other uses are listed in this book. Interestingly, it was for its medicinal uses that tobacco use was first introduced into Europe and, from there, to the rest of the world (Singer 1913).

One of tobacco's earliest European advocates was France's minister (a form of ambassador) to Portugal Jean Nicot. Having learned about its curative powers from members of Christopher Columbus's crew, Nicot immediately sent seeds and instructions on how to grow and use tobacco to his queen, Catherine de Medici. This former

matriarch of the great Italian Medici banking dynasty used tobacco for the relief of persistent headaches. Word of its medicinal uses rapidly spread throughout Europe and, within 200 years, to all corners of the earth. To honor the role that Nicot played in introducing this New World plant to the rest of the world, the father of modern taxonomy, Carolus Linnaeus, named the genus after him. There are currently 64 recognized species of *Nicotiana*. At least 15 of those have been smoked, with *N. tabacum* and *N. rustica* being the most common. Most people now smoke tobacco for pleasure, the bulk of which is the Virginian tobacco *N. tabacum*. Its main active constituent is nicotine, a pyridine alkaloid produced in the leaves. Standard filtered cigarettes contain between 1 and 16 mg of the substance. Other substances include nornicotine and tobacco camphor.

Today, cigarette smoking is a multibillion-dollar industry with millions of smokers worldwide. It is estimated that by 2050, there will be approximately 2.2 billion smokers globally. Tobacco products have generated enormous revenues for tobacco companies and governments. In 1999, the retail value of these was worth U.S. $47 billion to Philip Morris alone (Mackay and Eriksen 2002). Smoking impacts our economies in less obvious ways, too. The illnesses caused by its consumption place an enormous burden on our public health systems. In 1999, the cost of smoking-related health care in the United States alone accounted for 6% of its total health-care expenditures for that year (Mackay and Eriksen 2002). These figures do not, however, take into consideration the enormous personal cost to the families and loved ones of those affected by smoke-related diseases. Each year, approximately 3 million people die from illnesses related to its consumption (Peto et al. 1996). This figure is expected to rise to 10 million during the next 30 to 40 years.

Many tobacco products are produced today, including bidis, kreteks, cigarillos, cigars, cheroots, stumpens, chuttas, dhumtis, pipes, and sticks (figure 11). Their preparation often requires plants that are harvested from the wild. This poses interesting conservation problems for the countries where they occur. In India, where the cigarettes of the Indian working class, called *bidis*, are made (Rathore 1972), tobacco is rolled in tendu leaves (*Diospyros melanoxylon*). Many Indian towns and villages rely on these leaves for their income. The ever-increasing demand for the leaves has resulted in more plants being harvested from the wild, challenging local conservationists (Hunter 1981). The active constituent in tobacco, nicotine, is one of the most physiologically demanding and addictive substances on Earth. Various products and methods are currently available to help people quit smoking tobacco. Native Americans traditionally smoked the leaves of Indian tobacco, *Lobelia inflata,* to help them reduce their dependence on tobacco (Tierra 1983). This plant's active constituent, lobeline, has been included into tobacco smoking cessation aids in some parts of the world (Lancaster et al. 2000). Indian tobacco was also smoked for pleasure, asthma relief, and as a substitute for tobacco when it was scarce. At least 23 species were smoked when tobacco was unavailable. Some, like coltsfoot (*Tussilago farfara*) and great mullein (*Verbascum thapsus*), are known for their medicinal properties. Others were favored for their hallucinogenic or narcotic properties, some of which have been blamed for incredible acts of cruelty and murder.

During his travels through Persia, the famous thirteenth-century Venetian merchant Marco Polo learned about a famous separatist Islamic sect, known as *Nizari Ismaili,* that apparently prepared for assassinations and killing sprees by smoking hashish (cannabis resin). This story, later retold in his book *Il Milione,* claimed that

Figure 11. Smoking the cigarettes of the Indian working class, bidis. Photograph courtesy of Jorge Reverter.

members of the sect, a schism of the Shiite branch of Islam, had sworn to live, die, and kill at the command of their leader, Hasan ibn-Sabah. For centuries, their name, Hashshashins, was thought to have been the result of their alleged use of hashish. However, Martin Booth (2003) believes that the sect got its name for other reasons and that it was unlikely that its soldiers smoked hashish prior to engaging their enemies. Cannabis use was widespread in the region at that time but was mostly for medicinal and spiritual purposes. That ibn-Sabah's famous elite *fida'i* foot soldiers, whose reputation chilled the blood of even battle-hardened warriors, smoked hashish when preparing to kill makes little sense. Not only was it unlikely to render them more murderous but also probably would have clouded their judgment and diminished their abilities to fight. Regardless, their fierce reputation and name, Hashshashins, later gave rise to a new word in European parlance: assassin.

Many of the plants that were smoked for their psychotropic, narcotic, or sedative properties have similar stories that make for fascinating reading. In 1844, William Cornwallis Harris reported that sorcerers in Abyssinia (now Ethiopia) forced youth suspected of stealing to smoke dried jimsonweed (*Datura stramonium*) leaves, subduing them to the point where they were more amenable to confessing (Harris 1844). Bedouin thieves in Egypt, in sharp contrast, used the smoke of burning *Hyoscyamus muticus* leaves to dope their victims so they could steal from them with little or no resistance (personal communication by Kassas in Osborn 1968). In parts of South America, the leaves of *Brugmansia* species, a genus closely related to the daturas, were mixed with tobacco and given to women and slaves to deaden their senses prior to being buried alive with their dead husbands or masters (Avery 1959). All these narcotics have reputations that are well deserved, but there is one that stands above all others: opium.

Humans started regularly smoking opium in China approximately 300 years ago (Booth 1996). Opium is obtained in sap form after the unripe seedpods of the opium poppy, *Papaver somniferum,* are scratched. Its use, however, may date back to the time of the Egyptian pharaohs, with one of the oldest known samples of opium discovered in the Temple of Cha. Records of opium use appear in early herbals and engravings, including the *Ebers Papyrus* of Egypt and in ancient Greek and Roman

texts. Discoveries in Switzerland have, however, cast serious doubt on its historicity. Evidence for opium poppy cultivation was recently uncovered in a small Neolithic village in Switzerland, suggesting that it may have been deliberately grown there as early as 4000 B.C. (Booth 1996). It is not known whether or not the plant was used for medicinal, religious, or other purposes, however.

The Arabian people were among the first to realize the economic potential of selling opium. From their growing fields in the Middle East, they transported the substance to India, China, and elsewhere (Berge 2004). Demand for the commodity grew so rapidly in China that it soon emerged as one of the world's largest markets for the narcotic. The Chinese traded tea and other goods to pay for their addiction, creating a serious dilemma for the imperial ruling elite of the Manchu (Xun 2004). India quickly established itself as one of the principal suppliers of opium, with total revenue estimated at approximately U.S. $950 million (Booth 1996). The British East India Company, having also realized the potential of opium trade, quickly cornered the market and was soon shipping the narcotic to all parts of the world, especially China, where its effects were felt the hardest.

In his chapter of the *Cambridge History of China,* John King Fairbank (1978), an expert in Chinese studies, wrote that the British-dominated trade of opium in China was one of the longest "international crimes of modern times." He claimed that the British had "trampled on the sovereign rights of China to enforce a shameful trade which reduced the country to a state of opium slavery." Many now believe that its trade also enslaved India's people, opium's major producers ultimately. China's rapidly dwindling monetary reserves and worsening health and welfare crisis led to bans on opium use (Moreas and Moreas 2003). Punishments for those who ignored the edicts included floggings, and repeat offenders were exiled or beheaded (Holder 1898). Chinese officials did not always rigorously enforce the bans, however, and often allowed considerable quantities of the substance to enter the country as contraband.

In an attempt to do his part to stem the flow of opium into his country, the High Commissioner of Canton Lin Tse-Hsü (Zexiu) in 1839 led a meticulous campaign against its smugglers and traffickers. Ship captains were ordered to provide the commissioner with complete inventories of their cargo, during which time any opium found on the ships was promptly confiscated. Lin seized and destroyed nearly 30,000 chests of the substance, translating to a monetary loss of approximately $10 million to its traders (Holder 1898). The British government felt compelled to intervene and formerly declared war against China on October 1, 1839, in what was to be the first of two opium wars (1839–1842 and 1856–1860). Having underestimated the military might of Britain, the Chinese suffered enormous losses in personnel. To save his country, Chinese Emperor Qing was forced to sign several treaties that have since been referred to as the "unequal treaties." As part of those agreements, Hong Kong was ceded to the British and converted into a free port. Five other ports were similarly opened up for trade. In addition, China was forced to pay 21 million silver dollars for the war effort and to reimburse British and American opium traders. For the role he played in this chapter of China's history, Lin was exiled and never allowed to return to his country (Waley 1958).

The practice of smoking opium rapidly spread throughout the world, most of it following Chinese immigrants. Approximately 30% of Chinese workers on San Francisco's railroads and mines during the 1800s were addicted to the narcotic (Holder 1898). The immigrants smoked the substance in opium dens, another of its features that spread

with Chinese immigrants. Only in the quiet confines of dimly lit opium dens did smokers find refuge from loud noises and bright lights, neither of which are tolerated during a state of narcosis. They were also considered ideal meeting places, especially in China. Brothels were quick to realize the potential of the new market and began offering opium as part of their service (Xun 2004). Most smokers preferred to lie on a bed or mat when they smoked the narcotic. This was not necessary but convenient because they usually fell into a deep sleep that lasted from minutes to hours depending on how much opium they had smoked. Many of its users claimed that their "trips" helped them transcend to new heights of intellect and consciousness. Upon awaking, they felt calm, subdued, and in a state of lassitude with no aftereffects, such as hangovers.

Cocaine is also well known for its use as an illicit drug. Cocaine powder, obtained from the coca plant, *Erythroxylon coca,* is usually inhaled through the nose as a sulphate derivative. In more recent times, it has been smoked to induce its euphoric effects. Cocaine can, however, only be smoked if it is chemically converted into freebase cocaine. The name crack cocaine is also commonly used and may have derived from the sound that freebase cocaine makes when it is burned (Castoldi 2004). When smoked, the alkaloid is rapidly absorbed into the bloodstream, inducing an almost immediate effect. The introduction of crack cocaine during the 1980s, and its subsequent popularization by celebrities, has opened the door for a whole new class of cocaine users.

Alkaloids, such as cocaine from the coca plant, morphine from opium, and the tropanes of *Datura* species, have a therapeutic basis to account for their properties. However, not all compounds are pharmacologically active, even though they may seem that way to some users. In a 1967 issue of the highly influential 1960s underground newspaper, the *Berkeley Barb,* it was reported that smoking the charred scrapings of banana peels (*Musa acuminata*) induced psychedelic visions. The origins of that story are uncertain but may have been inspired by Donovan Leitch's song "Mellow Yellow." The rest of the media quickly seized on the story, forcing the U.S. Food and Drug Administration to investigate. The government agency concluded that smoking banana peels did not induce psychedelic visions. The "effects" experienced by many of its users were not due to chemical substances but rather to psychic suggestibility (Bozzetti et al. 1967). Similar household items have been smoked throughout the world for various reasons. Sun-dried plantains, a relative of bananas, were smoked for pleasure in Nigeria (Okiy 1960). Others include mangoes, oranges, peaches, coconuts, rice, cinnamon, fennel, oats, oregano, mints, rosemary, turmeric, and cashews. A total of 156 plants from 69 countries were used for 267 recreational purposes.

Pest Control

Insects and other pests have annoyed humans personally since we first appeared on this earth. They have tormented us with their bites, stings, and venoms and are vectors for some of the deadliest diseases known. Their ability to congregate, often in plague proportions, has also resulted in losses to agriculture totaling in the billions of dollars. To combat these pests, humans have resorted to a variety of different pesticides and pest repellents. Synthetic compounds, such as DEET, are used throughout the world and are still effective agents after more than 50 years in use (Fradin 1998). Others, like DDT, were just as effective but wreaked such havoc with our environment that they had to be abandoned.

Synthetic agents like these are mostly used in developed countries that can afford to buy them. Poorer third world nations have had to rely on natural substances

derived from plants and other organisms. The use of naturally based insect repellents can be traced to the time of the *Ebers Papyrus* of Egypt (ca. 1500 B.C.). A number of repellents are listed in the text (Bedenheimer 1928). Since then, approximately 2,400 plant species have been employed globally as pest control agents (Grainge and Ahmed 1988). Many of these have yielded useful chemical substances or have served as templates for the production of synthetic analogues. Products like the pyrethroids have become standard ingredients in smoke-generating formulas.

Pyrethroids are based on the naturally occurring pyrethrins produced by the flower heads of *Chrysanthemum* species (Charlwood and Jolley 1984; Lewis and Elvin-Lewis 2003). Two are listed in this book—*Chrysanthemum cinerariaefolium* and *C. roseum*—both of which were burned to produce insect repelling smoke (Grieve 1971). Commercially available pyrethroids are effective at low doses, and unlike DDT, they exhibit a low level of mammalian and avian toxicity. Pyrethroids cause the voltage-regulated sodium channels of their intended targets to remain open, eventually resulting in paralysis first and then death as a result of it. Both of the *Chrysanthemum* species listed are among more than 165 plant species that were burned to keep pests at bay. Nowhere is this more common than in the tropics, where smoke is one of the most widely used methods for repelling insects (Moore and Lenglet 2004). In places like Papua New Guinea, plant-derived smoke is considered a useful tool for providing personal protection against mosquitoes (Vernede et al. 1994). Using natural pest control agents eliminates the need to import large quantities of expensive synthetic chemicals, many of which are beyond the financial means of most third world nations.

Almost half of the plants that were burned for pest control were used specifically to repel mosquitoes. Mosquitoes, like so many of their insect relatives, are vectors for dangerous diseases, such as malaria, yellow fever, and Dengue fever. Malaria is a major cause of disease that affects millions of people each year (World Health Organization 2005). It is a leading cause of death in children under 5 years of age, with up to 1 million people of all ages dying from it each year. Eighty percent of victims live in tropical Africa. Malaria, meaning "bad air," often occurs in areas where stagnant waters are common and where the *Anopheles* species of mosquito vectors that carry the disease are found. The illness is caused by protozoan infections of *Plasmodium falciparum* and other related species. These are transmitted to humans usually at dusk by female anopheline mosquitoes in search of a blood meal. A number of remedies, herbal and synthetic, exist for treating malaria, but emphasis is placed mostly on avoiding the pests that cause this and other equally devastating illnesses.

One of the best-known sources of natural mosquito repellents is leaves of the neem tree, *Azadirachta indica* (Forster and Moser 2000), which were burned extensively in Africa (Aikins et al. 1994; Heine and Legére 1995; Pålsson and Jaenson 1999b). The active constituent is a tetranotriterpenoid called azadirachtin. Citronella grass, *Cymbopogon nardus,* is also known for its use as a mosquito repellent (Chomchalow 1993). It produces citronella oil, which was burned traditionally in Southeast Asia and is now common elsewhere in the world. In Bolivia, central Asia, and India, mugwort (*Artemisia vulgaris*) was considered ideal for warding off disease-causing pests (Hwang et al. 1985). Researchers showed that the main active compounds in its leaves were predominantly monoterpenes. Other common smoke-producing insect repelling plants include members of the mint family, Lamiaceae, with at least seven species of *Ocimum* (basils) burned throughout Africa (Dalziel 1937; Kokwaro 1976).

Common household items can also be burned to control pests (figure 12). In Papua New Guinea, the smoke of burning coconut husks (*Cocos nucifera*) was used to drive away two disease-causing mosquito species (Vernede et al. 1994; figure 13). Wild mango wood and betel nut leaves were similarly considered useful. In Kenya, rice husks were deliberately burned to repel mosquitoes (Ongore et al. 1989), and in Ghana and Sierra Leone, orange peels were burned (Aikins et al. 1994). The smoke of burning coffee beans tested positive for its mortality on honeybees and a species of tracheal mite (Eischen and Vergara 2004). Its active principle, caffeine, and other related methylxanthines are considered natural insecticides. Similarly, maize (*Zea mays*) smoke was also lethal to the bees and mites (Eischen and Vergara 2004). Other useful plants include hemp (*Cannabis sativa*), reported for its insect repellent properties in Hungary (Vajkai 1943), and tobacco (*Nicotiana* spp.). The active compound in tobacco leaves, nicotine, is commonly used in greenhouses as a fumigant to kill soft-bodied insects and other pests (Rechcigl and Rechcigl 1999). In rural Malawi, locals burned green grass to repel insects (Rubardt et al. 1999).

Figure 12. Several common household foods were smoked for various purposes around the world. Included are bananas, cashews, chamomile, chili peppers, cinnamon, coconuts, coffee, garlic, mangoes, mint, onion, oranges, oregano, peaches, rice, rosemary, and turmeric.

Figure 13. Smoke from burning coconut husks was considered useful for deterring mosquitoes.

The use of pest repellents for keeping ectoparasites and food pests away from stored agriculture crops also plays a major role in developing countries. Panagiotakopulu et al. (1995) have reviewed their use and importance in ancient times. In addition, they reported that various methods were employed to protect Late Bronze Age storerooms in Akrotiri, a site on the Greek island of Santorini, including airtight compartments, oils, minerals, ash, and various natural plant and animal substances. In more contemporary times, the treatment of grains and other stored food products with plant-derived smoke is an effective and inexpensive means to protect them from insect and fungal infestations. Up to 12% of Nigerian farmers, for example, currently use smoke as a method of control. This has significantly reduced the levels of fungal aflatoxin attack (Bankole and Adebanjo 2003). Similar results have been reported in Benin in western Africa (Hell et al. 2000). Paasonen et al. (2003) have suggested that smoke not only decreases microbial contamination due to endophytic species but may also improve seed germination. A total of 165 species of plants from 41 countries are described in this book along with 184 uses.

Perfumes, Flavoring, and Preservation

The origins of perfumes and their use are not known but were probably born in the fires of our primitive ancestors. The word *perfume* is derived from the Latin words *per fumum* meaning "to smoke." Early humans would almost certainly have recognized that many of the plants they burned produced fragrant smoke. This may have influenced their choice of firewood. With time, our ancestors would have noticed that pleasant smelling smokes could mask the odor of putrefaction and death. Its use in this capacity was common in ancient civilizations, such as Egypt, Rome, and Greece. The ability for odors, good or bad, to evoke powerful emotions in us and help us to recall significant events in our lives also influences the nature of the aromas that we surround ourselves with. Furthermore, pleasant aromas can lead us to mates, which is one of the primary uses for most perfumes. The combination of these factors has resulted in a multibillion-dollar perfume industry that may owe its very existence to our forebears and the fires they lit for their survival.

Bacteria and other organisms rapidly contaminate foods that are not protected or preserved in some way. These can be treated with a variety of chemicals, many of which occur in plant-derived smoke. Formaldehyde, a potent preservative, may be one of the many chemicals introduced into foods by smoke (Wilson 1991). Species, such as white mangrove and African mahogany, have exhibited antibiotic properties against *Staphylococcus aureus, Saccharomyces cerevisiae,* and *Eschirichia coli,* three bacteria known to spoil food (Asita and Campbell 1990).

Despite some of the dangers involved in preserving and flavoring foods with plant-derived smoke, it is doubtful that these practices will cease anytime soon (figure 14). Smoked foods are as highly sought after by food connoisseurs as wines fermented in oak barrels are to Chardonnay enthusiasts. Kippers, once considered a luxury for society's elite, are typical of the type of smoked foods that are high in demand. Hundreds of cookbooks describe how to smoke foods and beverages. They also recommend the best woods to burn. These include hickory, mesquite, oak, maple, and various fruit trees. With the advent of modern food storage and preserving devices, there is no longer any real need to smoke foods except to satisfy our own culinary preferences. The survival of humans may, however, have depended on it in earlier times. We may never know, however, when this practice first started. Its history is as amorphous as

Figure 14. Like most uses for plant-derived smoke, the preservation and flavoring of various foods, containers, and animal hides are ancient practices. Photograph by Robert E. Ritzenthaler. Courtesy of Milwaukee Public Museum.

the smoke that was used. Early archeological records discovered in an Irish site close to the River Bann, where fish may have been preserved with smoke, date back to the second millennium B.C. (Wilson 1991).

Seventy-one plant species were reportedly useful in preserving and flavoring foods. Relatives of frankincense and myrrh trees were commonly used in Africa. Another interesting species was kewda (*Pandanus fascicularis*). The male spadices, which are often considered flowers, were important sources of income and perfumery products in India (Dutta et al. 1987). For more than 200 years, kewda was used to make soaps, bouquets, lotions, and hair oils. It was also used in the preparation of incense sticks (agarbatties), for scenting clothes, and for flavoring tobacco (*Nicotiana* spp.), betel, and food.

To dilute or mask the taste and effects of tobacco, a variety of plant species have been smoked with them. Almost 100 plants were used for this purpose, many by Native Americans who smoked the harsh wild tobacco *N. rustica*. The native Algonquin word for these mixtures and blends was *kinnikinnick*. This term should not be confused with the bearberry plant, *Arctostaphylos uva-ursi,* which was also smoked for various reasons and referred to at times as kinnikinnick. A variety of plants, including dogwoods (*Cornus* spp.) and sumacs (*Rhus* spp.), served as adulterants that diluted tobacco or gave it a more refined taste. Many of today's commercially available cigarettes are flavored with *Mentha* species (mints), giving them a strong menthol taste. Other flavoring agents include licorice (from *Glycyrrhiza glabra*), camphor (from various sources), and the fruits of prunes and peaches (*Prunus* spp; Lewis and Elvin-Lewis 2003). Indonesia's kreteks cigarettes are flavored with the oil of cloves (*Eugenia aromatica*). Throughout their 100-year history, kreteks have been so popular that

billions of clove cigarettes are produced each year, providing employment, directly and indirectly, to approximately 10 million people (Hanusz 2003). It is interesting to note that before the process of rolling these uniquely Indonesian cigarettes was mechanized, they were rolled by hand. Up to 38 billion were produced manually in 1977 alone (Hanusz 2004). Today, there are more than 500 hundred kretek manufacturers, most of them using machines to roll their products.

Eugenol, the major constituent of clove oil, is considered useful for respiratory complaints, and to this day, kreteks continue to be marketed for this property. Of the 71 species, 24 were burned specifically to preserve or jerk foods, especially meats. Plant-derived smoke was also used in the preservation and tanning of animals hides. References to its use were reported in North America but were also common in parts of Africa.

Veterinary Uses

In all, 32 plant species from 15 countries were reportedly burned to generate smoke that was considered ideal for protecting domestic livestock. In some instances, smoke was specifically generated to harm or even kill animals (see the following section on Toxic and Obnoxious Smoke). Veterinary uses for plant-derived smoke range from helping to heal the wounds of castrated animals, to treating specific illnesses, and to protecting them from evil. A total of 35 uses have been reported, with most of these occurring in North America and Africa.

In parts of Hungary, an unspecified species of willow (*Salix* sp.) was once considered ideal for helping to heal the wounds of cattle that had recently been castrated (Vajkai 1943). This may have also helped with the pain since known analgesics, such as salicyclic acid (active ingredient in aspirin), have been isolated from the bark of *Salix vulgaris*. In parts of Turkey, the dwarf elderberry, *Sambucus ebulus,* was used for similar purposes (Yeşilada et al. 1999), while in North America, the Ramah Navajo used smoke from burning the leaves of coyote's tobacco, *Nicotiana attenuata,* to treat wounds of castrated horses (Vestal 1952).

Most of the veterinary uses for plant-derived smoke were for treating illnesses, especially those of horses. These were reported for parts of North America and Africa. In North America, almost one-third of plant-derived smoke uses were for treating distemper in horses. Known also as strangles because of the swelling the disease causes in lymph nodes, horse distemper is a highly contagious disease caused by the bacterium *Streptococcus equi*. This upper respiratory tract disease can affect horses of any age and may hamper their ability to breathe. The disease is fatal only in approximately 5% of all cases. In Africa, the animals most commonly treated for illnesses with plant-derived smoke are cattle. In some cases, the smoke was considered useful in preventing animals from leaving their *kraals* (enclosures for cattle; Hutchings et al. 1996).

In other cases, plant species were burned to keep evil at bay from animals or to bless them. Perhaps one of the species better known for this purpose was the black henbane, *Hyoscyamus niger*. For centuries, Europeans used to, on June 23—the eve of St. John the Baptist's birthday—burn this henbane in their barns to protect cattle from evil (Schleiffer 1979). Livestock were often crucial to the survival of individuals, families, and entire communities, especially in poorer times and areas, and so protecting them was considered important. The smoke of burning seeds was also said to be useful in protecting children from witches, sickness, and bad luck. Considerable

effort went into producing the smoke, some of which was fanned out across fields of crops to protect them as well. Interestingly, the smoke of black henbane was used in several parts of the world to relieve toothache and for respiratory problems. The leaves were also smoked for recreational purposes. The lighting of fires for St. John's birthday has persisted since the fourth century, when it replaced the ancient summer solstice celebrations of pagan times. Brushwood of any type is now used to make the fires. However, neither the smoke nor its uses are considered important in the ceremonies of today, most of which only celebrate and recognize the saint's birthday.

Toxic and Obnoxious Smoke

All throughout our history, hundreds of plants have inadvertently or deliberately been used to poison humans and their animals. Poisonous plants, such as tobacco and jimsonweed, alluded to previously, have a reputation for seriously harming and killing people. Ironically, they have also found use as medicinal agents. This duality in their nature is common for many poisonous plants. The fine line that exists between their ability to cure and kill, known as the therapeutic index, is almost always dependent on the dose of the extracts or substances used. Many of the drugs available today have such a large therapeutic index that dose is not always a critical factor. Others, such as the cardiac glycosides produced by *Digitalis,* oleanders, and related species, are infinitely more dangerous when determining the correct dose. This is also true if they are smoked.

Cardiac glycoside-producing plants, such as *Nerium oleander,* reportedly carry harmful and sometimes deadly compounds in their smoke when burned (Nelson 2000). This is one of at least 52 plant species known to do so, but there are probably countless more that have gone unreported. Related species, *N. indicum* and *N. odorum,* were deliberately burned as part of an interesting polyherbal recipe that was used during warfare according to the ancient fourth-century B.C. Sanskrit treatise the *Kautilīya* of *Arthaśāstra* (Sensarma 1998). Many ingredients were listed in the treatise, including well-known poisonous plants such as the castor-oil tree, *Ricinus communis,* of which the chaff of its seeds was used. Castor-oil tree seeds produce a highly poisonous protein, called *ricin*, which made world headlines in 1978 when Bulgarian dissident and reporter Georgi Markov was assassinated with the substance. If a poison does in fact exist in the smoke generated by burning the chaff of castor-oil tree seeds, it is, however, unlikely to be ricin. Like most proteins, ricin's chemical structure would denature during its combustion and lose its lethal effects in the process. Other poisons must be responsible if indeed the chaff is as harmful as claimed.

Also well known for its toxicity is poison ivy (Myths and facts about poison ivy 1998). Like so many *Toxicodendron* species, this plant produces an oleoresin, called *urushiol*, which upon contact with skin, eyes, and hair of humans and other animals causes dermatitis and other allergic reactions. This can occur even if the plant is burned. If inhaled, urushiol-containing smoke can severely irritate the lining of the respiratory tract and lungs. Hundreds of thousands of people are affected by it each year, many due to its smoke. This figure now looks likely to increase along with rising levels of global atmospheric carbon dioxide (CO_2). Higher CO_2 levels could potentially increase the species' population biomass and promote the production of a more allergenic form of urushiol (Mohan et al. 2006). This is just one more of the many incentives for reducing CO_2 emissions.

Another interesting source of harmful smoke agents is the chili pepper, *Capsicum annuum*. The Jívaro of eastern Ecuador burned and administered chili pepper fruits in a way that would generally be considered an excessive form of punishment to children. Juvenile delinquents were often forced to stand over the fumes of chili pepper fires when they had misbehaved (Harner 1984). A related species, *C. frutescens,* was burned in Panama because its smoke was believed to be harmful to evil spirits (Duke 1968) and could drive away mosquitoes and other pests (McIndoo 1945; Hartzell 1947). These uses are understandable considering the painful, burning sensation associated with chili's active constituent, capsaicin. Interestingly, the ancient Maya of Mesoamerica found a medicinal use for chili smoke, claiming that it was ideal for relieving sore throats and whooping cough (Asprey and Thornton 1955). This remedy might also seem excessive to some.

While many plants specifically produce toxic or obnoxious substances, every single plant—like all organic matter—produces and releases potentially harmful compounds when not completely incinerated. These substances include carbon monoxide (CO), polycyclic aromatic hydrocarbons (PAHs), particulate matter (PM), and various other compounds, such as phenols and cresols. Carbon monoxide is especially very dangerous. Its affinity for the hemoglobin in our red blood cells (erythrocytes), which is considerably greater than that of oxygen, makes it extremely toxic in large volumes. Carbon monoxide is a significant cause of many accidental and deliberate deaths, including suicide. A number of other undesirable effects are also due to this gas. In rural Guatemala, pregnant women who cook over open wood fires often produce babies with lower mean average birth weights (Boy et al. 2002). This effect is also known to occur in pregnant women who routinely smoke tobacco (*Nicotiana* spp.) or passively inhale its smoke during their pregnancies.

Polycyclic aromatic hydrocarbons (PAHs) can be equally as devastating to the health of humans. Studies by Löfroth et al. (1991) and many others have revealed that tobacco and other herbal cigarettes, incense materials, mosquito coils, meat, and other cooked foods all emitted PAHs, many of which tested positive in the Ames Salmonella test. This is considered a useful short-term standard bacterial bioassay for determining the potential mutagenecity of substances (Atta-ur-Rahman et al. 2001). One of the more carcinogenic of the 600 or so PAHs is benzo[*a*]pyrene (Howard and Fazio 1980; Bjφrseth and Ramdahl 1985). Interestingly, in a translated version of John Gaddesden's 1492 edition of *Rosa Medicina,* smoked foods are listed as a cause of epilepsy (Eadie and Bladin 2001).

Unspecified Uses

Some of the reports we used to compile this book did not include details of where or how the plants generating useful plant-derived smoke were used or who used them. A total of 46 plants with 59 unspecified uses from 14 countries fall into this category. Also listed in this book are plants whose smoke was used as a signaling device.

Despite their common association with Native American people, smoke signals have also played an important role in Catholic traditions that date back hundreds of years. The Catholic Church uses smoke to signal it has achieved *Habemus Papam* (it has elected a new pope). This occurred as recently as April 19, 2005, when a crowd of 100,000 people gathered in St. Peter's Square to await news on Pope John Paul II's successor. At 5:49 P.M. on day two of the papal conclave, a plume of white smoke slowly billowed out of the chimney above the Sistine Chapel, where the Sacred College of

Cardinals meets to cast their ballot. German Cardinal Josef Alois Ratzinger was chosen by a two-thirds majority ballot to fill the vacant See of Saint Peter and become the Vicar of Christ.

The use of smoke to announce the selection of a new *Pontifex Maximus,* or Holy Roman Pontiff, is one of the most famous traditions of papal succession rites. The ballot sheets used by the cardinal selectors are burned to generate the white smoke. Chemicals are added to the fire for black smoke, which was traditionally produced by burning wet straw and used to announce that no decision had been reached. Smoke was also used in other forms of communication. Before the advent of modern communicating devices, smoke signals were used to communicate across vast distances by at least two cultures. This is an age-old practice that was independently developed by Native Americans and by the Chinese for use on the Great Wall. There were usually no standardized codes, so each group was forced to develop their own, limiting their use.

Seed Germination

Seed germination is reportedly also affected by plant-derived smoke. Our ancestors may have used smoke in this capacity for centuries. Only recently has the scientific community delved into understanding the ecology of smoke as a seed dormancy-breaking mechanism in fire-prone environments. Most research to date has focused on, but is not limited to, the fire-prone Mediterranean environments of the western United States, Western Australia, and South Africa. These environments are among the richest floristic regions in the world, with 3,500 to 9,000 species, and are considered priority areas for conservation. Appropriate management of these regions requires an understanding of the ecology of these ecosystems. Knowledge of the role that smoke plays in breaking seed dormancy is one small but highly important component of the multifaceted complexities of fire ecology. Not all species respond to smoke cues, however. Some require other environmental cues or multiple cues to germinate. The seed dormancy mechanism often determines which cue is required to initiate germination.

On a final note, the human population has exponentially grown to approximately 6.6 billion people, with most of that growth occurring in the twentieth century. This growth has driven humans to further exploit plant species, leading to extinction in some cases. Without focused conservation measures, this imbalance between plant use and plant species survival may have disastrous consequences.

Conservation biology is defined by its goal of preserving biodiversity. Whether a plant species is exploited for smoke, medicine, food, shelter, or beautification, there are two primary conservation issues that arise when humans use wild plant species. The species may be overharvested and threatened with genetic erosion and ultimately extinction, or the species may be cultivated outside its native range and become weedy or invasive, thus threatening other species. Readers are encouraged to help conserve plants by minimizing overharvest and by not introducing invasive species into other countries.

Lists of Plants

Plant species are arranged in alphabetical order according to genus name and species epithet. The binomial names listed are those reported in the original texts unless they have since changed. When this was the case, the latest accepted name is listed, with

the original name also included. Synonyms are only given in some cases. All nomenclatural authorities and family names were similarly extracted from original texts and verified using a number of Internet resources. These include the International Plant Names Index (IPNI; www.ipni.org), the Missouri Botanical Garden's W³TROPICOS Nomenclatural Database (www.tropicos.org), the U.S. Department of Agriculture's (USDA) Plants Database (plants.usda.gov), and GRIN Taxonomy for plants (www.ars-grin.gov). All nomenclatural authorities were abbreviated and standardized according to those reported in Brummitt and Powell (1992).

Only one common name is given for each of the plant species. In many cases, no English vernacular names were reported in original texts. When this was the case, local names were used. In many cases, the locally used common names for some plant species are also included within the text along with the geographical location and name of the users. When no common names were found, the plant's genus name was given. In many cases, more than one plant has been assigned the same common name.

Uses for plants include the country where they were reported, the names of the groups of people who used them, and the parts of the plants used. If any special smoking methods or paraphernalia were required to generate or inhale the smoke, these too have been included along with all relevant references. A total of 98 plant species include line diagrams. All of the illustrations in this book were checked by various botanists and plant experts at the Chicago Botanic Garden and elsewhere. Internet sites, such as GRIN taxonomy and others mentioned earlier, were also consulted to check the illustrations.

Not included are recipes for modern-day incense products or information on the many different brands currently available for purchase. Other commercially available smoke products, such as those used to flavor beverages and foods, have similarly been omitted unless they were specifically of ethnobotanical use.

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LIST OF PLANTS

***Abies amabilis* Dougl. ex Forbes (Pinaceae). pacific silver fir.**

The Native American Ojibwa, who occupied the upper Midwest of the United States and parts of Canada, inhaled the smoke of burning leaves to treat colds (Smith 1932). The Nitinaht of British Columbia, Canada, burned the boughs and inhaled the smoke to prevent sickness (Turner et al. 1983).

***Abies balsamea* (L.) Mill. (Pinaceae). balsam fir.**

Unspecified parts of this species were burned as incense in Iceland (Bjornnson 1475). In parts of North America, Native Americans threw the needles on hot coals in their sweat baths and inhaled the fumes to relieve coughs and colds (Krochmal and Krochmal 1973). The gum from the tree was used in churches in Paris as frankincense (Lescarbot 1609).

Abies balsamea

***Abies grandis* (Dougl. ex D. Don) Lindl. (Pinaceae). grand fir.**

The Nitinaht of British Columbia, Canada, burned the boughs of this species in their fires and inhaled the smoke to prevent general sickness (Turner et al. 1983).

***Abies lasiocarpa* (Hook.) Nutt. (Pinaceae). Rocky Mountain fir.**

The Crow, who inhabited parts of Montana and Wyoming, burned the twigs and leaves of this species for incense purposes (Uphof 1968) and during certain ceremonies (Blankinship 1905). The Blackfoot, also of Montana and parts of Canada, inhaled the smoke from smudges made with the needles to treat headaches, to help an unconscious person recover, and to treat tuberculosis (Hellson 1974). It was also used as a fumigant for people whose faces had swollen because of venereal diseases and to help sick horses. The Cheyenne of Montana and Oklahoma burned the needles as incense when people were frightened of thunder (Hart 1981). They considered the aromatic smoke useful for chasing away bad influences. The Nez Perce of Idaho, Oregon, and other parts of the United States burned the boughs as incense in sweathouses (Hart 1996). The Native Americans of the Rocky Mountain area of the United States burned the twigs and leaves for smoke that was used for unspecified purposes (Usher 1974).

***Abies spectabilis* Spach (Pinaceae). Himalayan fir.**

The dried needles were burned for their pleasing aromatic smoke in Nepal (Manandhar 2002).

***Abies* spp. (Pinaceae). firs.**

The Carrier of British Columbia, Canada, used the smoke from burning rotten wood to smoke and tan animal skins (Carrier Linguistic Committee 1973). The

resin and needles of various species of firs were used in Europe, especially Germany and Switzerland, for the preparation of incense candles that were burned during Christmas (Rätsch 2004). The resin and needles were burned as part of shaman incense mixtures that included *Hyoscyamus niger* L., *Juniperus communis* L., *Artemisia vulgaris* L., *Taxus baccata* L., and *Thymus serpyllum* L.

***Abrus precatorius* L. (Fabaceae). rosarypea.**

According to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), the seeds of this species, when burned together with the leaves of *Gossypium herbaceum* L., the seeds of *Guilandino bunducella* L., *Jasminum* L. sp., *Careya arborea* Roxb., cow dung, and various salts, will produce smoke that causes blindness in one's enemies (Sensarma 1998).

***Acacia adsurgens* Maiden & Blakely (Fabaceae). walpiri mulga.**

Native Australians inhaled the smoke produced by burning the leaves of the walpiri mulga tree to help relieve diarrhea (Latz 1995).

***Acacia ancistrocarpa* Maiden & Blakely (Fabaceae). pirraru.**

Parts of the whole plant, especially the leaves, were burned by Native Australians to produce smoke that was considered useful for relieving diarrhea (Latz 1995).

***Acacia aneura* F. Muell. ex Benth. (Fabaceae). mulga.**

Native Australians used unspecified parts of the mulga tree to strengthen newborns as well as to stem the flow of postpartum bleeding and induce lactation in mothers (Barr 1993). In the Northern Territory of Australia, the leaves and twigs were burned for smoke that promoted good health in babies.

***Acacia dictyophleba* F. Muell. (Fabaceae). pilpirrinpa.**

Native Australians burned parts of the entire plant, especially the leaves, for smoke that was considered useful for treating diarrhea (Latz 1995).

***Acacia glaucophylla* Steud. ex A. Rich. (Fabaceae). Acacia.**

Traditional healers in Tanzania on Africa's East Coast used this species to treat epilepsy. Patients were covered with a blanket and encouraged to inhale the smoke produced by burning leaves (Mushi et al. 2005).

***Acacia goetzei* Harms. (Fabaceae). purplepod acacia.**

Borana women in southern Oromia, Ethiopia, used a variety of plants, such as this one, to perfume their clothes and bodies (Gemedo-Dalle et al. 2005). Most of the women possessed a special saunalike cubicle in their huts consisting of a pit that was approximately 50 cm deep and 30 cm wide. Sticks were hammered into the ground to enclose the cubicle, to which there was a single entrance. The women cut up pieces of their favorite plants and burned them in a special pit. The chamber was then covered with a mattress or blanket made of cattle hide. Once ready, the women disrobed and entered into the chamber. They sat on small stools, keeping their heads out to avoid suffocation. This traditional cleansing method has two advantages. First, the women sweat in the saunalike conditions, which naturally cleanses their bodies. Second, the aromatic smell carried in the smoke of the plants is long lasting and may have the same effect as modern perfumes. Elsewhere, the Gabbra of Kenya burned the wood of this species for incense purposes (Heine and Brenzinger 1988).

***Acacia horrida* Willd. (Fabaceae). doornboom tree.**

The Rendille of Kenya's Marsabit District fumigated their containers with the smoke generated when burning this species (Heine and Heine 1988b).

***Acacia horrida* Willd. ssp. *benadinensis* (Fabaceae). doornboom tree.**

This plant was used for the same purpose as *A. horrida* Willd. (Heine and Heine 1988b).

***Acacia kempeana* F. Muell. (Fabaceae). witchetty bush.**

The leaves and other parts of the whole plant were burned to produce smoke that was thought to be useful in relieving diarrhea (Latz 1995). Elsewhere, in the Northern Territory of Australia, the leaves were burned near newborn babies so that they could inhale the smoke to promote well-being and stem the flow of postpartum bleeding in their mothers (Barr 1993).

***Acacia ligulata* A. Cunn. ex Benth. (Fabaceae). dune wattle.**

The smoke generated by burning leaves and other parts of this plant was inhaled by indigenous Australians to relieve diarrhea (Latz 1995).

***Acacia lysiphloia* F. Muell. (Fabaceae). turpentine bush.**

The leaves and other parts of this species were mixed with dust scraped off termite mounds and were burned by indigenous Australians so that the smoke produced could be inhaled to treat postpartum bleeding in new mothers and to promote general well-being in the rest of the tribe (Barr 1993).

***Acacia macrothyrsa* Harms (Fabaceae). large leafed acacia.**

In Bulamogi County, Uganda, root powder was smoked to treat epilepsy (Tabuti et al. 2003).

***Acacia mellifera* Benth. (Fabaceae). black thorn.**

The Mukogodo Maasai of the Laikipia District of northern Kenya burned the wood to fumigate their milk containers and improve the milk's flavor (Brenzinger et al. 1994).

***Acacia mellifera* Benth. ssp. *mellifera* (Fabaceae). black thorn.**

The Chamus (Heine and Heine 1988a) and Pokot (Timberlake 1987) of Kenya burned the bark to fumigate, clean, and perfume their milk containers. The Pokot name for the species is *talamo*.

***Acacia nilotica* (L.) Delile (Fabaceae). prickly acacia.**

People of the Kharga and Dakhla Oases of Egypt smoked powdered fruits for the relief of nasal congestion (Osborn 1968).

***Acacia nilotica* (L.) Delile ssp. *subalata* (Vatke) Brenan (Fabaceae). Egyptian mimosa.**

The Rendille of the Marsabit District of northern Kenya fumigated and cleansed various containers by burning this plant (Heine and Heine 1988b).

***Acacia nubica* Benth. (Fabaceaea). pelil.**

The Chamus of Kenya burned the wood of pelil to fumigate and clean their containers (Heine and Heine 1988a). This was common also with the Gabbra of Kenya's Marsabit District and with the Borana of Ethiopia (Heine and Brenzinger 1988).

***Acacia pellita* O. Schwartz. (Fabaceae). soapbush.**

The Native Australians of Groote Eylandt forced overexcited children to inhale the smoke of burning soapbush leaves. They claimed that it made them slow down and stop (Levitt 1981). Note: The identity of this species, known locally as *marra,* was not confirmed and may have been a closely related acacia (Levitt 1981). This species may have been smoked for similar purposes elsewhere in Australia (Bindon 1996).

***Acacia pruinocarpa* Tindale (Fabaceae). black gidgee.**

The leaves and other parts of this acacia were considered ideal for burning and producing smoke that was thought to be useful in relieving diarrhea (Latz 1995).

***Acacia salicina* Lindl. (Fabaceae). Broughton wattle.**

Native Australians burned the leaves and inhaled the smoke to induce deep and lengthy sleep (Webb 1969). According to Latz (1995), Native Australians also inhaled smoke from the leaves for other unspecified medicinal properties.

***Acacia senegal* Willd. (Fabaceae). gum Arabic.**

In Bulamogi County, Uganda, the roots were burned, and the smoke was inhaled to treat migraines (Tabuti et al. 2003). This plant was sold as incense in the markets of Jima, Ethiopia, where it is known as *it'an* (Siegenthaler 1971).

***Acacia senegal* Willd. ssp. *keniensis* (Fabaceae). gum Arabic.**

The Borana of Ethiopia and the Gabbra of Kenya burned the wood of this species as incense (Heine and Brenzinger 1988).

***Acacia seyal* Delile (Fabaceae). shittim wood.**

In Nigeria, the wood of this wattle was burned for smoke that was considered an excellent insecticide (Ainsle 1937).

***Acacia tortilis* Hayne (Fabaceae). umbrella thorn.**

Smoke generated in saunalike chambers in their private huts was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Acalypha fruticosa* Forssk. (Euphorbiaceae). copperleaf.**

The villagers of Tongoni in Tanzania's Tanga District and from the village of Kijango in the Korogwe District burned the dried leaves of this species and inhaled the smoke to cure various diseases of the skin (Hedberg et al. 1983).

***Acalypha ornata* Hochst. ex A. Rich. (Euphorbiaceae). Iushete.**

In parts of Tanzania, smoke generated by burning unspecified parts of this species was inhaled twice a day to treat epilepsy (Mushi et al. 2005).

***Acalypha* sp. (Euphorbiaceae). copperleaf.**

The Zulu of South Africa burned the twigs of an unspecified species of copperleaf to produce smoke that was considered useful for treating headaches (Gerstner 1938).

***Acalypha villicaulis* Hochst. ex A. Rich. (Euphorbiaceae). Kaiso kampagna.**

Men of Bulamogi County, Uganda, smoked the leaves of this plant when they wanted to divorce their wives (Tabuti et al. 2003).

***Acer negundo* L. (Aceraceae). box elder.**

Native North Americans burned the wood of box elder for incense purposes (Usher 1974).

***Acer saccharinum* L. (Aceraceae). silver eye maple.**

According to Grieve (1971), the wood of this species, when burned, can seriously harm the eyes.

***Achillea lanulosa* Nutt. (Asteraceae). yarrow.**

Both the Pillager Ojibwa and Forest Potawatomi of North America burned the flowers of yarrow and inhaled the smoke to reduce fever and to revive comatose people (Smith 1932). Moerman (1998) suggests that the species actually used may have been *Achillea millefolium* var. *occidentalis* DC.

***Achillea millefolium* L. (Asteraceae). common yarrow.**

The Forest Potawatomi of North America burned the florets of this species to reduce fevers and to revive comatose patients. Other Potawatomi tribes placed the flowers on hot coals to prepare a smudge that was believed to keep witches and evil spirits away from people in a comalike state (Smith 1933; Vogel 1970). The Native American Flambeau Ojibwa and Pillager Ojibwa smoked dried flowering heads

for ceremonial purposes (Smith 1928; Smith 1932). The Pillager Ojibwa also placed the florets on hot coals, inhaling the smoke to break fevers (Smith 1928). The Colville of North America prepared a smoke smudge that was used to keep mosquitoes away (Turner et al. 1980). In Isthmian America, which includes all the countries from Mexico to Colombia, the common yarrow was smoked when tobacco was not available (Duke 1986). In Ireland, the leaves were smoked in pipes to relieve toothache (Fargher 1969).

Achillea millefolium

***Achillea millefolium* L. var. *occidentalis* DC. (Asteraceae). western yarrow.**

The Ojibwa of North America smoked the flowering heads during certain ceremonies (Smith 1932). They added flower heads to their kinnikinnick mixtures, which were also smoked for ceremonial purposes. This species was reported as *A. lanulosa* Nutt. in original texts.

***Achyranthes aspera* L. (Amaranthaceae). devil's horsewhip.**

In Tanzania (formerly Tanganyika), parts of this plant were added to tobacco to improve its flavor (von Reis and Lipp 1982).

***Acokanthera oppositifolia* (Lam.) Codd. (Apocynaceae). bushman's poison.**

According to the Vendan of South Africa, women should avoid the smoke produced when this species is burned. It is said to cause prolonged menstruation (Arnold and Gulumian 1984). The Vendan name of this species is *murungula*.

***Acokanthera schimperi* Oliv. (Apocynaceae). arrow poison tree.**

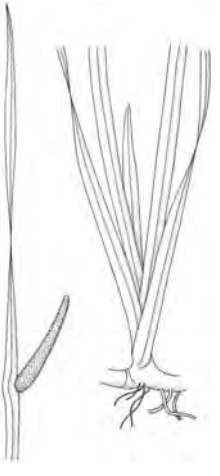
In Ethiopia, smoke from burning arrow poison tree wood was used to treat liver disease (Getahun 1976). Getahun (1976) warns that the smoke from burning arrow poison tree wood may be toxic. It was also used to kill insects.

***Acokanthera* spp. (Apocynaceae). bushman's poison.**

In Ethiopia, the dried roots and twigs of various species of *Acokanthera* were burned to generate smoke that reportedly repelled insects (Neuwinger 1994).

***Acorus calamus* L. (Acoraceae). sweet flag.**

This plant was considered sacred in parts of India, where it was used as a fumigant for the relief of pain associated with piles (hemorrhoids; Dhiman 2003). In the Bankura District of West Bengal, India, smoke from burning rhizomes was inhaled by people suffering from epilepsy and hysteria (Saren et al. 2000). The Iroquois of North America smoked the roots to relieve toothache (Herrick 1977). After inhaling the smoke, they sucked it into the hollows of the decayed teeth. The smoke of burning roots was considered a useful remedy for colds according to the Pawnee of North America (Gilmore 1919). Other Native Americans smoked powdered rhizomes and roots for pleasure (Youngken 1924).



Acorus calamus

***Actiniopteris radiata* Link (Actiniopteridaceae). morpankhi.**

To the Bhils of the Chandipur area of Jhalawar District of India's Rajasthan State, fumigations of dried leaves were highly prized for driving away the *nazar*, or "evil eye," which often affects male babies (Sharma, N. K. 2004).

***Adansonia digitata* L. (Bombacaceae). baobab.**

In Ghana and Gambia, the leaves were thought to be useful, when burned, to produce a mosquito-repellent smoke (Aikins et al. 1994).

***Adenocalymma alliaceum* Miers (Bignoniaceae). cipo d'alho.**

The leaves were burned as ritual incense in Brazil's state of Pará, where it was readily available for purchase in the Ver-o-Peso markets of Belém (van den Berg 1984).

***Adiantum aethiopicum* L. (Adiantaceae). maidenhair.**

Unspecified African tribes smoked the fronds (large leaves with many divisions) of this fern to treat colds (Cribb and Cribb 1981).

***Adiantum capillus-veneris* L. (Adiantaceae). southern maidenhair.**

The dried fronds of the southern maidenhair were smoked in Lesotho, Africa, for the relief of head and chest colds (Jacot Guillarmod 1971), a use for which it was also employed in parts of Europe (Roberts 1990). Native Americans encouraged mentally unstable people to burn the leaves of this species to generate smoke that was believed to drive away bad spirits (Foster and Hobbs 2002).

Adiantum capillus-veneris

***Adiantum fuliginosum* Fée (Adiantaceae). Hah-pi ah-wah-rah.**

Smoke produced by burning the entire plant was inhaled in parts of Suriname to reduce fever (Defilipps et al. 2004).

***Adiantum lanulatum* Burm. f. (Adiantaceae). Kane unya.**

In Nepal, rhizomes were burned on fires to generate smoke that was inhaled to treat intermittent fever (Manandhar 1991). This species was originally reported as *Adiantum philippense* L.

***Adiantum pedatum* L. (Adiantaceae). five-finger fern.**

The Cherokee of North America gathered dried fronds, powdered them, and then smoked the powder for heart problems (Hamel and Chiltoskey 1975). The complete plant was powdered and smoked to relieve asthma attacks.

***Adiantum tenerum* Sw. (Adiantaceae). black stick maidenhair.**

The leaves were sometimes smoked in parts of Africa to relieve head and chest colds (Asprey and Thornton 1954b).

***Aerva lanata* (L.) Juss. ex Schult. (Amaranthaceae). Aerva.**

In Bulamogi County, Uganda, where this species is known as *lwelya,* the whole plant was burned in an earthen pot to generate smoke that was reputed to help one overcome a criminal case (Tabuti et al. 2003).

***Aeschynanthus poilanei* Pellegr. (Gesneriaceae). greensleeve.**

In parts of Indo-China, the smoke produced by burning this species was inhaled as a decongestive medicine by women who had just given birth (Pételot 1953).

***Agastache neomexicana* (Briq.) Standl. (Lamiaceae). New Mexico giant hyssop.**

The Navajo and Ramah Navajo of North America used this species in fumigations to treat deer infections (Vestal 1952). Moerman (1988) suggests that the species actually used may have been *Agastache pallidiflora* (A. Heller) Rydb. ssp. *neomexicana* (Briq.) Lint & Epling var. *neomexicana* (Briq.) R. W. Sanders.

***Agastache pallidiflora* (A. Heller) Rydb. ssp. *neomexicana* (Briq.) Lint & Epling var. *neomexicana* (Briq.) R. W. Sanders. (Lamiaceae). big Williams mountain giant hyssop.**

The Navajo and Ramah of North America burned this plant as a fumigant for treating deer infections (Vestal 1952). This species was reported as *Agastache neomexicana* (Briq.) Standl. in original texts.

***Agathis dammara* (Lamb.) Rich. (Araucariaceae). dammar pine.**

The resin of this pine was burned in the Cordillera region of northern Luzon in the Philippines to produce smoke that was inhaled to relieve bronchial asthma (Co 1989). The local name for the species is *almasigia*. The resins produced by the species are sold over the Internet, frequently trading under the names gold or black copal.

***Agathisanthemum bojeri* ssp. *bojeri* Klotzsch (Rubiaceae). Agathisanthemum.**

The seeds of this species were smoked for respiratory problems and asthma by the Karanga of Zimbabwe (Watt and Breyer-Brandwijk 1962).

***Ageratina altissima* R. M. King & H. Rob. var. *roanensis* (Small) Clewell & Woot. (Asteraceae). white snakeroot.**

The Chickasaw of North America prepared smoke smudges to revive unconscious people (Smith 1928). This species was reported as *Eupatorium urticaefolium* Reichard in original texts.

***Ailanthus malabarica* DC. (Scrophulariaceae). white bean.**

The scented resin of white bean was harvested and burned for incense purposes in parts of India (Usher 1974).

***Ailanthus triphysa* (Dennst.) Alston (Simaroubaceae). white sirus.**

This species was used in the preparation of incense materials in parts of India (Cribb and Cribb 1981).

***Albizia amara* Boivin (Fabaceae). bitter false thorn.**

In southern Oromia, Ethiopia, the smoke generated in saunalike chambers in personal huts was used to perfume and cleanse Borana women (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Alchornea latifolia* Sw. (Euphorbiaceae). loblob.**

In Jamaica, loblob was smoked in a pipe as part of a treatment for toothache (Asprey and Thornton 1954b).

***Alepidea amatymbica* Eckl. & Zeyh. (Apiaceae). larger tinsel flower.**

The roots of this species, which is called *kalmoes* in Afrikaans, were smoked in parts of Africa to cure coughs and colds in children (Watt and Breyer-Brandwijk 1962). The smoke of burning roots was also inhaled as a mild sedative (Hutchings and van Staden 1994). In Zimbabwe, the smoke was inhaled to treat headaches (Chinemana et al. 1985).

***Alhagi camelorum* Fisch. (Fabaceae). Arabian manna plant.**

In Concan, India, this plant was smoked along with a *Datura* sp., tobacco (*Nicotiana* spp.), and the seeds of the ajwan plant—probably *Trachyspermum ammi* (L.) Sprague ex Turrill—to relieve asthma (Jayaweera 1981b).

***Alhagi pseudoalhagi* (M. Bieb.) Desv. ex B. Keller & Shap. (Fabaceae). camelthorn bush.**

The leaves of this plant were smoked to treat asthma in Mt. Abu, Rajasthan State, India (Sebastian and Bhandari 1984).

***Allenrolfea occidentalis* Kuntze (Chenopodiaceae). iodine bush.**

This plant was regarded as one of the first plants created according to the Seri of Mexico. They used it during a number of smoking ceremonies (Felger and Moser 1985).

***Allionia nyctaginea* Michx. (Nyctaginaceae). heartleaf four o'clock.**

The Western Keres of North America smoked the leaves as a tobacco (*Nicotiana* spp.) substitute (Swank 1932). The species actually used may have been its synonym, *Mirabilis nyctaginea* (Michx.) MacMill. (Moerman 1998).

***Allium cepa* L. (Alliaceae). onion.**

The smoke of burning onion bulbs was used as a fumigant for unspecified purposes during childbirth in Hungary, where the name for onion is *vöröshagyma* (Vajkai 1943). In India, it was used to prevent childbirth. Vaginal fumigations of onions mixed with wild pigeon feces were said to induce abortions in pregnant woman according to the Ayurveda (Venkataraghavan and Sundaresan 1981). In parts of Ankara, in central Anatolia, Turkey, the red outer husks of onion bulbs, the white outer husks of garlic bulbs (*Allium sativum* L.), and the seeds of *Peganum harmala* L. were burned together to fumigate rashes and other skin disorders of the extremities or chest (Sezik et al. 2001).

***Allium porrum* L. (Alliaceae). garden leek.**

According to Avicenna, the fruits of garden leeks were smoked in Iran for the relief of toothache (Mohagheghzadeh et al. 2006).

***Allium sativum* L. (Alliaceae). garlic.**

The bulbs of garlic were mixed with pig excrement and burned in Hungary, where the smoke was used to calm frightened children (Oláh 1987). In parts of Ankara, in central Anatolia, Turkey, the white outer husks of garlic bulbs, the red outer husks of garlic bulbs (*Allium cepa* L.), and the seeds of *Peganum harmala* L. were burned together to fumigate rashes and other skin disorders of the extremities or chest (Sezik et al. 2001).

***Allium* sp. (Alliaceae). onions.**

The Blackfoot of North America inhaled smoke from onion smudges to treat headaches and to fumigate patients with colds. A bulb smudge was prepared for sinus troubles (Hellson 1974). Elsewhere, smoke from burning onions was used to flavor foods (Bogenschtz-Godwin and Ducellier 2002).

***Allophylus griseotomentosus* Gilg. (Sapindaceae). qadíída.**

The Borana of Ethiopia and the Gabbra of Marsabit District, Kenya, cut pieces of dried branches, burned them, and then allowed them to fumigate the insides of camel milk containers (Heine and Brenzinger 1988).

***Alnus crispa* Pursh (Betulaceae). sitka alder.**

In parts of Canada, the Inuktitut burned the bark of this species to produce smoke that they inhaled to treat rheumatism (Wilson 1978). The Upper Tanana of Alaska burned the wood to smoke fish (Kari 1985). Moerman (1998) suggests that the species actually used may have been *Alnus viridis* (Vill.) Lam. & DC. ssp. *crispa* (Ait.) Turrill.

***Alnus rhombifolia* Nutt. (Betulaceae). white alder.**

The Karok of North America burned the wood to smoke salmon, eels, and venison (Schenck and Gifford 1952).

***Alnus rubra* Bong. (Betulaceae). red alder.**

In British Columbia, Canada, the Kwakiutl (Boas 1935), the Bella Coola (Turner 1973), the Kitasoo (Compton 1993), the Nitinaht (Turner et al. 1983), the Oweekeno, the Thompson (Compton 1993), and native tribes from throughout the United States burned the wood of red alder to smoke and preserve salmon and other fish species (Uphof 1968; Usher 1974). The Haisla and Hanaksiala, also of Canada, burned the wood to smoke fish and meat (Compton 1993). The Southern Kwakiutl of British Columbia smoked the leaves for pleasure (Gill 1983).

***Alnus viridis* (Chaix) DC. ssp. *crispa* (Aiton) Turrill (Betulaceae). mountain alder.**

The Inuktitut of Canada burned the bark and inhaled the smoke to treat rheumatism (Wilson 1978). The smoke was also used as an insecticide to drive away mosquitoes and to smoke fish. The Upper Tanana of Alaska burned the wood to smoke fish (Kari 1985). This species was reported as *Alnus crispa* (Ait.) Pursh in the original texts.

***Aloe cooperi* Baker (Aloeaceae). grass aloe.**

The Zulu of South Africa used the smoke from burning leaves to protect their cows from poor fodder (Watt and Breyer-Brandwijk 1962).

***Alpinia* spp. (Zingerberaceae). wild ginger.**

The leaves of various *Alpinia* species were burned in Papua New Guinea because their smoke was thought to repel mosquitoes (Vernede et al. 1994).

***Alstonia boonei* De Willd. (Apocynaceae). cheesewood.**

Asita and Campbell (1990) reported that the wood of this species could be burned to produce smoke that effectively inhibited two species of bacteria—*Staphylococcus aureus* and *Saccharomyces cerevisiae*—both of which are known to spoil food.

***Alternanthera sessilis* (L.) R. Br. ex DC. (Amaranthaceae). sessile joyweed.**

In the western parts of Papua New Guinea, natives smoked parts of this plant as a general medicine (Perry 1980).

***Alyxia flavescens* Pierre & Pit. (Apocynaceae). Alyxia.**

The roots of this species were burned in South Vietnam and in Thailand to produce smoke for incense purposes (Uphof 1968).

***Alyxia psilostachya* DC. (Apocynaceae). Alyxia.**

Unspecified Native American tribes burned the whole plant for incense purposes (Usher 1974).

***Alyxia reinwardtii* Blume (Apocynaceae). pulasari.**

The bark of this species was used for the preparation of incense materials in Java, Indonesia (Sangat-Roemantyo 1990).

***Amaranthus hybridus* L. ssp. *hybridus* (Amaranthaceae). slim amaranth.**

Men of Bulamogi County, Uganda, smoked the leaves of this plant in a pipe made of banana stem when they wanted to divorce their wives (Tabuti et al. 2003).

***Amaranthus spinosus* L. (Amaranthaceae). edlebur.**

In the small South African area of Venda, every part of this plant was burned so that the smoke could be inhaled to prevent and stop dizziness (Arnold and Gulumian 1984).

***Amaranthus viridis* L. (Amaranthaceae). green amaranth.**

The entire plant was burned in Rayalaseema in Andhra Pradesh State, India, for its smoke, which was inhaled during bouts of dizziness (Nagaraju and Rau 1990).

***Amasonia campestris* (Aubl.) Moldenke (Lamiaceae). Wah-se-wha-se.**

Smoke generated by burning of the whole plant was used as a fumigant in Guyana to treat general illness (Defillips et al. 2004). *Wah-se-wha-se* is its Guyanese name.

***Ambrosia maritima* L. (Asteraceae). Ambrosia.**

In Saudi Arabia, the entire plant was crushed and then burned so that the smoke could be inhaled to relieve breathing difficulties (Ghazanfar 1994).

***Amorpha canescens* Pursh (Fabaceae). leadplant.**

The Oglala of North America dried the leaves, crushed them, mixed them with buffalo fat, and then smoked the mixture for pleasure (Gilmore 1919).

***Amorphophallus* sp. (Araceae). stinking arum.**

A nineteenth-century missionary living among Native Australians noticed that smoke produced by burning the dried leaves of this species induced an anesthetic effect similar to ether and chloroform (Cribb and Cribb 1981).

***Amorphophallus variabilis* Blume (Araceae). devil's tongue.**

Indigenous Australians smoked the leaves as a substitute for tobacco (*Nicotiana* spp.; Webb 1948).

***Amyris balsamifera* L. (Rutaceae). balsam torchwood.**

Balsam torchwood was popular for burning as incense in Cuba, Jamaica, Puerto Rico, and other northern areas of Latin America (Uphof 1968).

***Amyris elemifera* L. (Rutaceae). torchwood.**

This species produces an aromatic resin that was harvested and used for incense purposes and for voodoo ceremonies on the Caribbean island of Montserrat (Brussell 1997).

***Anacardium occidentale* L. (Anacardiaceae). cashew nut tree.**

This native of Brazil was grown for its nuts, oil, and gum. The nuts were usually dried in the sun and were then roasted on an open fire to remove caustic oils. The smoke that resulted from this roasting can irritate eyes, skin, and respiratory surfaces (Duke 1968; Nelson 2000).

***Anadenanthera colubrina* (Vell.) Brennan (Fabaceae). cevil.**

In northwestern Argentina, the seeds have been smoked or used as snuff powder for their hallucinogenic effects for more than 4,500 years (Schultes et al. 2001). The hallucinogenic compounds in this species are similar to those found in the skin secretions of certain frogs and toads.

***Anadenanthera colubrina* (Vell.) Brenan var. *cebil* (Griseb.) Altschul (Fabaceae). cevil.**

According to Califano (1975), Argentineans smoked this species mixed with tobacco (*Nicotiana* spp.). The Abipone of Paraguay inhaled the smoke for unspecified purposes (Dobrizhoffer 1822).

***Anadenanthera peregrina* (L.) Benth. (Fabaceae). yopo.**

Many Brazilians believed that the bark, when burned with dried cow dung, could repel insects, snakes, and other animals (Branch and Gersgoff 1990). In Guyana, the people smoked pulverized seeds for their psychoactive effects (de Smet 1985).

***Anaphalis contorta* Hook. f. (Asteraceae). everlasting.**

This plant was burned for incense purposes in the Manang District of Nepal (Pohle 1990).

***Anaphalis javanica* Sch.Bip. (Asteraceae). Javan edelweiss.**

The people of Java, Indonesia, burned the leaves and branches of this species for incense purposes (Sangat-Roemantyo 1990).

***Anaphalis margaritacea* (L.) Benth. & Hook. f. (Asteraceae). western pearly everlasting.**

Several Native American tribes smoked the leaves for pleasure and for curing headaches (Kavasch 1979). The Cherokee of North America smoked the leaves for treating colds and both the leaves and stems for the relief of bronchial coughs (Hamel and Chiltoskey 1975). According to Gerarde (1633), the smoke and fumes of dried herbs were inhaled for coughs, for headaches, and for cleansing "inward parts." The Flambeau of North America burned the flowers as incense and for reviving patients that have suffered paralysis due to stroke (Smith 1932). The Cheyenne, also of North America, burned the leaves as incense and to purify the

gifts they offered to their spirits (Grinnell 1905; Hart 1981). The Forest Potawatomi smoked dried flowers or placed them on hot coals to drive away evil spirits by irritating their eyes (Smith 1933). This species was also used for smoke therapies in Suffolk, Britain, where the leaves were smoked for treating coughs and headaches (Jobson 1967).

***Anaphalis royleana* DC. (Asteraceae). dhoop.**

The dried flowers of dhoop were burned for incense purposes during certain religious ceremonies in the small town of Rewalsar, India (Sood and Thakur 2004).

***Anaphalis triplinervis* Sims ex C. B. Clarke. (Asteraceae). pearly everlasting.**

Like *Anaphalis contorta* Hook. f., this plant was burned for incense purposes in the Manang District of Nepal (Pohle 1990).

***Andira inermis* (W. Wright) DC. (Fabaceae). cabbage bark.**

The smoke of burning wood was considered toxic and harmful to the eyes according to the Darien of Panama (Duke 1968) and others of Isthmian America (Mexico to Colombia) (Duke 1986). In Guyana, the smoke of burning fruit was considered a useful pest repellent (Defilipps et al. 2004).

***Andrachne ovalis* Müll. Arg. (Euphorbiaceae). false lightning bush.**

The roots, which are considered poisonous, were burned and inhaled by the Zulu. This was said to be ideal for treating headaches and snakebites, and it was useful as an emetic for chest complaints (Gerstner 1941).

***Anemone caffra* Harv. (Ranunculaceae). Anemone.**

In parts of southern Africa, smoke of smoldering roots was inhaled to treat colds and headaches (Watt and Breyer-Brandwijk 1962).

***Anemone fanninii* Harv. (Ranunculaceae). giant wild anemone.**

Like *Anemone caffra* Harv., the smoke of smoldering roots was used for treating colds and headaches in parts of southern Africa (Watt and Breyer-Brandwijk 1962).

***Anemone multifida* Poir. (Rananculaceae). windflower.**

The ripe seed heads were burned over hot coals in parts of North America to generate smoke that was inhaled for the relief of headaches (Foster and Hobbs 2002).

***Anemone obtusiloba* D. Don. (Ranunculaceae). Himalayan blue buttercup.**

In the Sikkim Himalayas of India, the roots, which some consider poisonous, were burned for incense purposes (Pandey 1991).

***Anemone virginiana* L. (Ranunculaceae). tall anemone.**

The Meskwaki of North America burned the seeds to produce smoke to treat catarrh and to revive unconscious people (Smith 1928; Vogel 1970). The smoke was directed up the nose of the patient using a special cone.

***Anemone vitifolia* Buch.-Ham. ex DC. (Ranunculaceae). Scarborough anemone.**

The entire plant was burned for incense purposes in the Manang District of Nepal (Pohle 1990).

***Angelica archangelica* L. (Apiaceae). Angelica.**

The roots of this species were mixed with tobacco (*Nicotiana* spp.) to add flavor to it (Lewis and Elvin-Lewis 2003). Neither the country nor its users were specified.

Angelica archangelica

***Angelica atropurpurea* L. (Apiaceae). purplestem angelica.**

The Delaware and Oklahoma of North America mixed the seeds of this species with tobacco (*Nicotiana* spp.) and smoked the mixture for pleasure and other unspecified purposes (Tantaquidgeon 1942). The seeds were probably added for flavor. The natives of Arkansas mixed the roots with tobacco (Lewis and Elvin-Lewis 2003). Other Native Americans smoked the leaves for recreational purposes (Kavasch 1979).

***Angelica breweri* A. Gray. (Apiaceae). brewer's angelica.**

The Shoshone, who practiced some of the most powerful medicine in North America (Rolling Thunder quoted in Pope 1999), dried and shaved the roots of this species and smoked them to treat headaches (Train et al. 1941). Smoke from the roots was also used to relieve horse distemper.

***Angelica* sp. (Apiaceae). angelicas.**

The Costanoan of California often smoked the roots of an *Angelica* species to relieve headaches (Bocek 1984). The Mendocino, also of California, smoked the roots to treat colds and catarrh (Chestnut 1902).

***Angelica tomentosa* S. Wats. (Apiaceae). woolly angelica.**

The shamans of the Pomo and Kashaya of North America smoked root shavings when doctoring (Goodrich et al. 1980). Smoke produced by burning the complete plant was employed by other Native American tribes to relieve headaches (Foster and Hobbs 2002).

***Aniba canelilla* Mez (Lauraceae). rosewood.**

In Guyana, smoke from burning stems was inhaled to relieve diarrhea (Defilipps et al. 2004).

***Annona ambotay* Aubl. (Annonaceae). karaxmia.**

The Waimiri Atroari of Brazil called this species *karaxmia*. They burned the bark and inhaled its smoke to cure "madness" (Milliken et al. 1992). The Alter do Chão of Pará, Brazil, inhaled the smoke from burning wood to treat various illnesses (Branch and Gersgoff 1990).

***Annona senegalensis* Pers. (Annonaceae). wild custard apple.**

To help keep spirits at bay, the people of Bulamogi County, Uganda, smoked the roots of this species (Tabuti et al. 2003).

***Annona squamosa* L. (Annonaceae). sugar apple.**

In parts of Mizoram, India, the smoke of burning seeds was inhaled for the treatment of epilepsy (Sharma et al. 2001).

***Annona stenophylla* Engl. & Diels. (Annonaceae). dwarf custard apple.**

This species was one of four ingredients in a Namibian smoke cure for the heart condition angina pectoris. Its roots, along with those of *Lablab purpureus* (L.) Sweet ssp. *uncinatus* Verdc. var. *rhomboideus* (Schinz) Verdc., *Lannea edulis* Engl., and *Parinari curatellifolia* Planch. ex Benth., were burned on glowing embers to produce smoke that was inhaled to treat other heart pains (von Koenen 2001).

***Antennaria aprica* Greene (Asteraceae). small-leaf pussytoes.**

The Navajo of North America mixed the leaves with tobacco and smoked them for pleasure and during medicine ceremonies (Ross 2002).

***Antennaria margaritacea* (L.) Sweet (Asteraceae). life everlasting.**

Ross (2002) suggests that the dried leaves of this species can be smoked for pleasure. No other details about its use were given.

***Antennaria neglecta* Greene (Asteraceae). field pussytoes.**

Native North Americans smoked the flowers and leaves for pleasure (Kavasch 1979). The Potowatomi used only the leaves for that purpose (Kavasch 1979). Other Native Americans generated the smoke to drive away bad spirits (Foster and Hobbs 2002).

Antennaria neglecta

***Antennaria rosea* Greene (Asteraceae). rosy pussytoes.**

The Okanagan-Colville of North America burned dried, powdered roots to drive away bad spirits and to revive unconscious dancers (Turner et al. 1980). The Blackfoot added the tiny dried leaves to their kinnikinnick mixtures (Nickerson 1966).

***Antennaria* sp. (Asteraceae). pussytoes.**

The Shoshone people of North America mixed the leaves of an unspecified species of pussytoe with tobacco (*Nicotiana* spp.) and smoked the mixture for pleasure and other purposes (Murphey 1990).

***Anthriscus nemorosa* Spreng. (Apiaceae). chervil.**

The smoke of this species was prized in the Ladakh region of India as a cure for rheumatism and inflammation (Navchoo and Buth 1989).

***Anthurium oxycarpum* Poepp. & Endl. (Aracaceae). laceleaf.**

Brazilian and Peruvian people added fresh leaves to tobacco (*Nicotiana* spp.) to enhance its flavor (Peckolt 1892; Lewin 1964). In other parts of tropical America, dried leaves were used for that purpose (Uphof 1968).

***Apocynum androsaemifolium* L. (Apocynaceae). spreading dogbane.**

Natives of North America inhaled the fumes of burning dried roots for the relief of headaches (Krochmal and Krochmal 1973). Similarly, the Pillager Ojibwa, also of North America, inhaled the smoke from burning roots for headaches (Smith 1932). The Chippewa of North America inhaled the fumes of powdered root to relieve headache or for mouth twitches (Densmore 1974).

***Apocynum cannabinum* L. (Apocynaceae). Indian hemp.**

The Pillager Obijwa of North America smoked the roots to relieve headaches (Adams 1951). Other Native Americans inhaled the smoke produced by burning dried plants as a remedy for asthma even though this species is considered poisonous (Foster and Hobbs 2002).

Apocynum cannabinum

***Aquilaria agallocha* Roxb. (Thymelaeaceae). agar.**

Agarwood was burned in India and China as incense (Willis 1894; Stuart 1911; Uphof 1959; Dutt 1961; Manning 1965) and was used in the preparation of joss sticks in China (Uphof 1968; Li et al. 1973). In parts of Malaysia, the wood was burned during Islamic prayers (Uphof 1968).

***Aquilaria beccariana* Tiegh. (Thymelaeaceae). gahuru.**

The people of Java, Indonesia, burned the wood of this species for incense purposes (Sangat-Roemantyo 1990).

***Aquilaria hirta* Ridl. (Thymelaeaceae). karas.**

Uphof (1968) reported that this species was used in the preparation of incense materials. No other details were given.

***Aquilaria malaccensis* Lam. (Thymelaeaceae). agarwood.**

The wood of this species was burned throughout the world for incense purposes (Barden et al. 2003), especially in Indonesia, where it was highly prized by the people of Java (Sangat-Roemantyo 1990). It was also burned as incense in India (Gastaldo 1969). The sap secreted during pathogenic attack contains resins, which impregnate the heartwood phloem fibers of the tree (Donovan and Puri 2004). The volume of resins in the heartwood determines the quality of the wood, known locally as *gaharu*. At least 17 *Aquilaria* species are known to produce the resins (Chung and Purwaningsih 1999). The better quality gaharu is used in the perfume industry, and poorer quality material is used for preparation of incense materials. Extensive overharvest of this and other *Aquilaria* species now threatens their existence, especially agarwood, an Indo-Malaysian tree whose Chinese name literally means "wood that stinks." The international trade of agarwood dates back to the thirteenth century. Several species may already be extinct in countries such as Bangladesh and Indonesia (Chakrabarty et al. 1994). This species has also been used for thousands of years for medicinal purposes (Barden et al. 2003).

***Aquilaria moszkowskii* Gilg (Thymelaeaceae). chamdan.**

According to Chung and Purwaningsih (1999) and Uphof (1968), the leaves of this and several other species of *Aquilaria* were used throughout the world for the preparation of incense materials.

***Aquilaria sinensis* Merr. (Thymelaeaceae). Chinese agarwood.**

Parts of this plant were burned for incense purposes on Hainan Island, China (von Reis and Lipp 1982).

***Aquilaria* spp. (Thymelaeaceae). agarwoods.**

According to Chung and Purwaningsih (1999), the leaves of several *Aquilaria* species were burned throughout the world for incense purposes.

***Aquilegia canadensis* L. (Ranunculaceae). wild columbine.**

Young Meskwaki people of North America mixed the ripe capsules of this species with their tobacco (*Nicotiana* spp.). Reportedly, this gave it a more refined flavor (Smith 1928).

***Aralia racemosa* L. (Araliaceae). American spikenard.**

The Malecite of New Brunswick, Canada, smoked the roots of the American spikenard to relieve headaches (Mechling 1959).

Aralia racemosa

***Arbutus menziesii* Pursh. (Ericaceae). Pacific madrone.**

The Hoh and Quileute of North America occasionally smoked the leaves for pleasure (Reagan 1936).

***Arcangelisia flava* Merr. (Menispermaceae). yellow fruit moonseed.**

Smoke from the branches of this plant was inhaled to relieve sprue (a tropical disease that causes diarrhea due to poor absorption of nutrients) in Indonesia and the Philippines (Boorsma 1920).

***Arcangelisia loureiroi* Diels (Menispermaceae). mountain dragon.**

Smoke from the branches of this species was inhaled to relieve sprue in Indonesia (Perry 1980).

***Arctium lappa* L. (Asteraceae). greater burdock.**

The shamans (*dumbus*) of the Shuhi, a Tibeto-Burman ethnic group that lives exclusively in the Shuiluo Valley of southwestern China, burned the leaves of this species to treat colds (Weckerle et al. 2006).

***Arctostaphylos alpina* Spreng. (Ericaceae). alpine bearberry.**

Arctostaphylos alpina

Raudot (1709) and Kalm (1770) reported that the natives of Quebec, Canada, frequently smoked this herb for pleasure, as did the natives of the Hudson Bay area (Isham 1743). Native Americans near the Great Lakes gathered dried leaves, powdered them, and then mixed the powder with tobacco (*Nicotiana* spp.) to dilute its effects (Carver 1778). Youngken (1924) noted that several "aboriginal tribes" ground dried leaves with those of tobacco or red willow (probably *Cornus amomum* Mill.) and smoked the mixture for pleasure. The shamans of Parry Island, near Lake Huron, North America, smoked the leaves during religious ceremonies that were meant to heal the sick (Jenness 1935). The Chippewa of North America smoked the leaves for relief from headaches (Densmore 1928). The Chippewa reportedly also smoked the leaves to induce a state of intoxication during certain medicine ceremonies (Reagan 1928). The Ojibwa, also of North America, smoked the leaves specifically to cause intoxication.

***Arctostaphylos glandulosa* Eastw. (Ericaceae). eastwood's manzanita.**

The Cahuilla of southern California mixed the leaves of this species with those of tobacco (*Nicotiana* spp.) and smoked them for unspecified purposes (Bean and Saubel 1972).

***Arctostaphylos glauca* Lindl. (Ericaceae). big berry manzanita.**

Like *Arctostaphylos glandulosa* Eastw., the Cahuilla mixed the leaves of this species with tobacco (*Nicotiana* spp.) (Bean and Saubel 1972).

***Arctostaphylos nevadensis* Gray (Ericaceae). pinemat manzanita.**

The Klamath of Oregon, North America, mixed the dried leaves of this species with those of tobacco (*Nicotiana* spp.) and smoked the mixture for pleasure (Coville 1897). The Paiute of the Great Basin region of North America added roasted leaves to their tobacco (Mahar 1953).

***Arctostaphylos patula* Greene (Ericaceae). greenleaf manzanita.**

Both the Klamath and Paiute of North America used the leaves of this species for the same purposes as *Arctostaphylos nevadensis* Gray (Coville 1897; Mahar 1953).

***Arctostaphylos pungens* Kunth (Ericaceae). pointleaf manzanita.**

The Cahuilla of southern California mixed the leaves with tobacco (*Nicotiana* spp.) and smoked the mixture for pleasure (Bean and Saubel 1972). The Ramah Navajo of western New Mexico smoked the dried leaves with mountain tobacco. This was believed to bring them good luck (Vestal 1952).

***Arctostaphylos tomentosa* (Pursh) Lindl. (Ericaceae). woollyleaf manzanita.**

The Hoh and Quileute of North America occasionally smoked the leaves for recreational purposes (Reagan 1936). To the south, in Mexico, the leaves were smoked for unspecified purposes (Santamaría 1942).

***Arctostaphylos uva-ursi* (L.) Spreng. (Ericaceae). bearberry.**

Arctostaphylos uva-ursi

The leaves of this species were often used to dilute harsh tobacco (*Nicotiana* spp.). The Chippewa of North America used the leaves of this species in the same way as those of *Arctostaphylos alpina* Spreng. (Krochmal and Krochmal 1973; Tierra 1983). They also smoked the leaves in a pipe to attract game (Densmore 1974). This species was used for a variety of purposes by many Native American tribes (see Moerman 1998, for a list of other uses and references). Native Americans also used the smoke of the leaves to treat earache (Foster and Hobbs 2002). Early European colonists may have mixed this species with tobacco (Lewis and Elvin-Lewis 2003).

***Areca catechu* L. (Arecaceae). betel palm.**

This species was used in the Malay Peninsula, where powdered leaves were smoked to relieve ulcerated noses (Burkill 1935). The smoke from burning leaves was used to repel mosquitoes in Papua New Guinea (Vernede et al. 1994).

***Arenaria macradenia* S. Wats. (Caryophyllaceae). Mojave sandwort.**

The Kawaiiso of southeastern California inhaled the smoke from dried roots to relieve headaches and to clear their sinuses (Zigmund 1981).

***Argemone mexicana* L. (Papaveraceae). Mexican prickly poppy.**

African American magicians believed that the seeds, when smoked, benumbed their proselytes (alien residents) (Grimé 1979). In Mexico, the smoke of burning seeds was used as a fumigant to relieve toothache (Jayaweera 1982a). According to the Urubama Valley people of southern Peru, foreigners, or gringos, smoked the flowers of this species as a substitute for cannabis (Franquemont et al. 1990).

***Arisaema enneaphyllum* Hochst. ex A. Rich. (Araceae). Arisaema.**

The Borana of Ethiopia and Gabbra of Kenya burned the wood of this species as incense (Heine and Brenzinger 1988).

***Aristolochia* sp. (Aristilochiaceae). Dutchman's pipe.**

In Guyana, the stems of an unspecified *Aristolochia* species were burned to produce smoke that was inhaled for the relief of coughs and other respiratory disorders (Defilipps et al. 2004).

***Artemisia absinthium* L. (Asteraceae). bhurse.**

Members of the Kibber tribe in India's Lahoul Valley (northwestern Himalayas) collected all the above-ground parts of this species, dried them in the sun, and then, when powdered, threw a pinch of the material on fires for incense purposes (Sood et al. 2001).

***Artemisia argentea* L'Hér. (Asteraceae). Madeira wormwood.**

This was one of many *Artemisia* species used for smoke therapies. In the Madeira Archipelago, an unspecified group of people smoked the leaves of this species for treating apoplexy (Rivera and Obón 1995).

***Artemisia californica* Less. (Asteraceae). coastal sagebrush.**

The Native American Cahuilla of southern California mixed this species with tobacco (*Nicotiana* spp.) and other plants and smoked the mixture to relieve colds (Bean and Saubel 1972).

***Artemisia douglasiana* Bess. (Asteraceae). Douglas's sagewort.**

The Costanoan on North America's West Coast burned the branches to drive bees away from their nests (Bocek 1984). The Kashaya Pomo, also of North America's West Coast, dried the leaves and smoked them as a tobacco (*Nicotiana* spp.) substitute (Goodrich et al. 1980). Other Native Americans inhaled the fumes of burning plants to treat influenza (Foster and Hobbs 2002).

***Artemisia dracunculus* L. (Asteraceae). tarragon.**

The Okanagan-Colville of British Columbia, Canada, and Washington, North America (Turner et al. 1980), and the Shuswap (Palmer 1975) of British Columbia used the branches for the preparation of smoke smudges that were used to ward off mosquitoes.

Artemisia dracunculus

***Artemisia frigida* Willd. (Asteraceae). prairie sagewort.**

Smoke from burning leaves and flowers was used by the Potowatomi of North America to revive comatose patients (Smith 1933). The smoke was produced by placing the flowers and leaves on hot coals. It was then directed up the nostrils using a cone of paper. The leaves were also burned to treat biliousness (Densmore 1974). The Chippewa burned dried leaves to produce smoke that was used to disinfect the rooms of sick people.

***Artemisia furcata* Bieb. var. *heterophylla* (Bess.) Hultén (Asteraceae). forked wormwood.**

The Meskwaki of Iowa prepared a smudge of the leaves to create a smoke treatment for ponies with distemper (Smith 1928).

***Artemisia gmelinii* Webb ex Stechm. (Asteraceae). gmelin's wormwood.**

Unspecified parts of this plant were used in the preparation of incense in India's Indus Valley (Ladakh region) (Singh et al. 1996).

***Artemesia indica* Willd. (Asteraceae). mugwort.**

The dried leaves were burned as incense in Nepal (Manandhar 2002).

***Artemisia japonica* Thunb. (Asteraceae). Japanese wormwood.**

In Nepal, the powder of dried plant material was burned for incense purposes (Manandhar 2002).

***Artemisia judaica* L. (Asteraceae). wormwood.**

Unspecified parts of this plant were burned by farmers of the Nile Valley area of Egypt to fumigate their poultry (Osborn 1968). Arab Bedouins in Egypt considered the smoke of burning wormwood leaves also ideal for promoting good health in babies and for warding off evil spirits (Osborn 1968).

***Artemisia ludoviciana* Nutt. (Asteraceae). white sagebrush.**

The Sioux of North America smoked white sagebrush for pleasure (Smith 1932). A smoke smudge was also used to revive unconscious people (Kindscher and Hurlburt 1998) and as incense during purification ceremonies (Rogers 1980). The Meskwaki of North America used a smoke smudge of the leaves to drive off mosquitoes (Smith 1928). The Thompson of British Columbia, Canada, used the smoke of the plant to cure animal hides and to ward off mosquitoes (Turner et al. 1990).

***Artemisia ludoviciana* Nutt. ssp. *ludoviciana* (Asteraceae). white sagebrush.**

The Chippewa of North America inhaled fumes from dried flowers as an antidote to "bad medicine." The Cheyenne burned dried leaves on coals to purify people and

utensils and to ward off the nightmares endured by sick people (Grinnell 1923). The Lakota burned this plant for incense (Rogers 1980).

***Artemisia maritima* L. var. *neercha* (Asteraceae). nyurcha.**

Members of the Beeling tribe in India's Lahoul Valley (northwestern Himalayas) collected the above-ground parts of this species, dried them in the sun, and then, when powdered, threw a pinch of this material, along with the leaves of various *Juniperus* species, on fires for incense purposes (Sood et al. 2001).

***Artemisia maritima* L. var. *seski* (Asteraceae). seski.**

Members of the Jahalman tribe in India's Lahoul Valley (northwestern Himalayas) burned this plant for incense purposes (Sood et al. 2001).

***Artemisia nilagarica* Pamp. (Asteraceae). Indian wormwood.**

The Kumaon of India burned aerial parts of this plant for incense (Shah and Joshi 1971).

***Artemisia parviflora* Buch.-Ham. ex Roxb. (Asteraceae). Himalayan wormwood.**

The shoots were burned as incense in the Kullu District of the northwestern Himalayas, India (Singh, G. S. 2000).

***Artemisia scoparia* Waldst. & Kit. (Asteraceae). redstem wormwood.**

In the village of Kahuta of the Rawalpindi District of Pakistan, the whole plant was burned for smoke that was considered useful for treating burns (Quereshi and Khan 2001).

***Artemisia sieberi* Bess. (Asteraceae). shih.**

Bedouins of Saudi Arabia inhaled the smoke produced by burning this plant for unspecified medicinal purposes (Mandaville 1990).

***Artemisia* spp. (Asteraceae). sagebrush.**

According to Bhattacharyya (1991), several species of *Artemisia* were used in the Ladakh region of India for incense purposes. The complete plant was burned.

***Artemisia thuscula* Cav. (Asteraceae). incensio.**

Aerial parts of this species were burned in the Canary Islands to produce smoke that repels insects (Darias et al. 2001).

***Artemisia tridentata* Nutt. (Asteraceae). big sagebrush.**

The Paiute of North America inhaled smoke produced by burning this plant for headaches and head colds (Train et al. 1941). The Okanagan-Colville of North America used it to smoke animal hides (Turner et al. 1980). The Washoe and Zuñi, also of North America, burned the plant after illness to purify sickrooms (Dweck 1997). The branches were often burned as a disinfectant after childbirth. The Cahuilla of southern California burned the leaves and stems to purify their abodes (Bean and Saubel 1972).

Artemisia tridentata

***Artemisia tripartita* Rybd. (Asteraceae). treetip sagebrush.**

The Okanagan-Colville of parts of Canada and the United States used this species to smoke animal hides (Turner et al. 1980).

***Artemisia vulgaris* L. (Asteraceae). common mugwort.**

This species was used in China and Japan, where the leaves were smoked to relieve asthma (Kariyone and Kimura 1949). In the Far East, the leaves were smoked as a tobacco (*Nicotiana* spp.) substitute (Usher 1974). It was also burned to produce smoke that repelled mosquitoes

in Bolivia, central Asia, and India (Hwang et al. 1985). Those researchers showed that the main active compounds were predominantly monoterpenes. In the Manang District of Nepal, the whole shrub was burned as incense (Pohle 1990). Mugwort was often used in an age-old Chinese form of acupuncture, called *moxibustion* (figure 15). A combination of heat and smoke from burning special moxa sticks was held over specific acupuncture meridian lines of the body, called *Qi lines*, to treat a variety of illnesses. This practice first arose during the Ming Dynasty of China (1368–1644 B.C.) (Wilcox 2005). Some of the uses for the smoke of mugwort listed in Li Shizhen's 52 volumes of the *Great Pharmacopoeia of 1578* (published in 1596) include treating numbness and paralysis, eliminating worms, and treating acne in females. It was also useful as a treatment for scab sores, shank sores due to coldness, toothache (wind worm), dysentery, and prolapse of the anus (Li 2004). Parts of mugwort were sometimes mixed with other herbs and materials, some of which may be threatened and endangered. There is concern that smoke from the other species may be toxic.

Artemisia vulgaris

***Artocarpus altilis* (Parkinson) Fosb. (Moraceae). breadfruit.**

Known in Samoa as *ulu*, the smoke of burning twigs was used as a fumigant to treat anal thrush (Whistler 2000). In Tonga, smoke from burning twigs was used as an antihelmintic agent (Whistler 1991).

***Asclepias eriocarpa* Benth. (Asclepiadaceae). woollypod milkweed.**

The Costanoan of central California burned entire plants of this species to produce smoke that was inhaled for asthma attacks (Bocek 1984).

***Asparagus adscendens* Roxb. (Liliaceae). khairuva.**

In Iran, the roots were smoked for the relief of toothache (Mohagheghzadeh et al. 2006).

***Asparagus buchananii* Baker (Liliaceae). asparagus.**

The leaves were burned in Venda, South Africa, for smoke that was inhaled for a one-off treatment of amenorrhea (Arnold and Gulumian 1984).

***Asparagus officinalis* L. (Liliaceae). common asparagus.**

In Tehran, Iran, the roots were burned to generate smoke that was inhaled for the relief of toothache (Hooper and Field 1937).

Figure 15. In an ancient form of Chinese acupuncture, the leaves of mugwort, *Artemisia vulgaris,* were burned in special moxa sticks that were used to direct heat to specific Qi meridian lines on the body. Inhaling the smoke produced by the burning leaves was often an integral part of the healing process.

***Asparagus racemosus* Willd. (Liliaceae). wild asparagus.**

According to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), this species, when burned together

with *Datura metel* L., *Ipomoea paniculata* R. Br., *Shorea surattense* Burm. f., *Solanum robusta* Gaertn., as well as two unspecified insects and one unspecified fish, can produce smoke that causes blindness in one's enemies (recipe 1; Sensarma 1998). This species was also a key ingredient in another similar concoction that included an unspecified reed, parts of *Butea monosperma* (Lam.) Taub. in Engl. & Prantl, *Paspalum scrobiculatum* L., *Ricinus communis* L., *Saussurea lappa* (Decne.) C. B. Clarke, *Stephania hernandiflora* Walp., and *Tragia involucrata* L. (recipe 2). In a third polyherbal recipe, in which the smoke was used to kill animals, *A. racemosus* was mixed with root, bark, flowers, leaves, and fruits of *Saussurea lappa* (Decne.) C. B. Clarke, the juice of *Semecarpus anacardium* L., and unspecified parts of *Vernonia anthelmintica* Willd. (recipe 3). The mixture also required parts of several animals. This species featured prominently in another mixture of plants that was burned to produce a lethal smoke also used to kill animals. The smoke was said to be so deadly that it could kill animals for as far as the wind carried it (Sensarma 1998). As part of this mixture (recipe 4), the powder of *A. racemosus* was burned with unspecified parts of the following plant species: *Lagenaria siceraria* (Mol.) Standl., *Nerium indicum* Mill., *Paspalum scrobiculatum* L., as well as the chaff of *Ricinus communis* L. and seed and grains obtained from *Xeromphis spinosa* (Thunb.) Keay.

***Asphodelus tenuifolius* Cav. (Asphodelaceae). onion weed.**

In the sub-Himalayan region of eastern Uttar Pradesh, India, the seeds of this species, known locally as *piazi,* were burned in earthen pots to give off fumes that were inhaled through the mouth for the relief of carious teeth (Singh, A. K. 2000).

***Aspilia mossambicensis* (Oliv.) Willd. (Asteraceae). hadaa.**

The roots of this species were used in conjunction with others to treat tuberculosis in northern and eastern Mozambique (Verzár and Petri 1987). Plant parts were dried and then placed with the rest of the mixture on glowing coals. The patients were covered with a blanket and encouraged to inhale the smoke. The other species in the mixture were *Clematopsis scabiosifolia* Hutch., *Clerodendron discolor* Becc., *Helichrysum kirkii* Oliv. & Hiern., and *Ozoroa schinzii* (Engl.) R. Fern. & A. Fern.

***Asplenium trichomanes* L. (Aspleniaceae). maidenhair spleenwort.**

Head and chest colds were treated in Lesotho, Africa, by inhaling smoke produced by burning the leaves of this species (Perry 1980; Duke and Wain 1981).

***Asplenium septentrionale* (L.) Hoffm. (Aspleniaceae). forked spleenwort.**

The leaves were smoked to treat chest and head colds in Bhaderwah Hill, Jammu Province, India (Kapur 1996a).

***Aster cordifolius* L. (Asteraceae). blue wood aster.**

The Flambeau Ojibwa of North America considered this species ideal for making smoke to attract deer (Smith 1932). The roots were burned.

***Aster furcatus* E. S. Burgess ex Britton & A. Brown (Asteraceae). forked aster.**

The Potawatomi of Wisconsin used the flowers in a smoke smudge preparation that was believed to ward off evil spirits, especially those that were hampering the recovery of sick patients (Smith 1933).

***Aster laevis* L. (Asteraceae). smooth aster.**

The entire plant was burned by the Meskwaki of Iowa to generate smoke that was used in sweat baths. A smudge was used to revive unconscious people (Smith 1928).

***Aster lateriflorus* (L.) Britt. (Asteraceae). calico aster.**

The blossoms of this species were smudged by the Meskwaki of Iowa to cure an insane person (Smith 1928). The entire plant was burned for its smoke.

***Aster lavandulifolius* Hand.-Mazz. (Asteraceae). Aster.**

The shamans, or *dumbus*, of a Tibeto-Burman ethnic group known as the Shuhi of southwest China often burned fresh branches of this plant as incense (Weckerle et al. 2006).

***Aster macrophyllus* L. (Asteraceae). bigleaf aster.**

The Flambeau Ojibwa of North America considered the disk florets of this species ideal for smoking as a hunting charm to attract deer (Smith 1932).

***Aster multiflorus* Ait. (Asteraceae). many-flowered aster.**

The Meskwaki of Iowa used the smoke of burning plants in sweat baths to revive unconscious patients (Smith 1928).

***Aster novae-angliae* L. (Asteraceae).**
New England aster (figure 16).

The Ojibwa of North America smoked the leaves for medicinal purposes and when hunting deer (Kavasch 1979). The root was smoked in a pipe by the Chippewa to attract game (Densmore 1974). The Meskwaki prepared smoke smudges to revive unconscious people (Smith 1928).

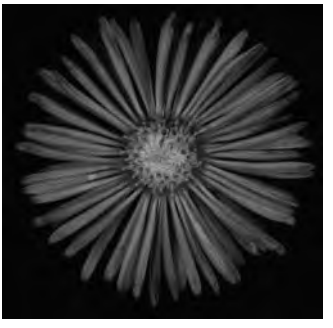


Figure 16. Like the New England aster (*Aster novae-angliae*), many species of *Aster* were smoked by Native North Americans to attract game.

***Aster praealtus* Poir. var. *coerulescens* (DC.)**
A. G. Jones. (Asteraceae). willowleaf aster.

The Ramah Navajo of North America smoked dried leaves to attract game (Vestal 1952).

***Aster puniceus* L. (Asteraceae). purplestem aster.**

The Chippewa of North America smoked the fine tendrils of the roots of this species in a pipe with tobacco (*Nicotiana* spp.) to attract game (Densmore 1974).

***Aster umbellatus* Mill. (Asteraceae). flat topped white aster.**

According to Smith (1928), the Meskwaki of Iowa inhaled the smoke produced by burning whole plants for reviving a fainting person (Smith 1928). The Potawatomi of Wisconsin used smoke smudges to ward off evil spirits from a sickroom (Smith 1933).

***Astragalus fasciculifolius* Boiss. (Fabaceae). Anzarut.**

The gum of this species was burned to produce a fumigant considered useful for treating ear disorders (Mohagheghzadeh et al. 2006).

***Astrocaryum aculeatum* G. Mey (Arecaceae). tucum palm.**

The Xiriana (Yanomamo) of northern Brazil burned the epicarp to smoke-cure rubber (Corrêa 1926–1975).

***Astronium urundeuva* Engl. (Anacardiaceae). urunday.**

The Izoceño-Guaraní of Bolivia inhaled smoke from the bark of this species to stop hemorrhaging of the nose (Bourdy et al. 2004). A decoction of the bark was prepared into a jellylike substance, which was then placed over burning charcoal to produce the smoke.

***Atamisquea emarginata* Miers (Capparaceae). palo zorrillo.**

The Seri of Mexico burned the wood of the palo zorrillo during many of their ceremonies, which they called *hamcáatxi*. The smoke was used to cure fussy

babies and to cure a turtle hunter's harpoon (Felger and Moser 1985). A female sponsor, called a *hamác,* passed the harpoon through the smoke during the process.

***Atractylis gummifera* L. (Asteraceae). pine thistle.**

Known in Morocco as *addad,* this species was one ingredient in a polyherbal recipe used in Morocco to induce abortions in women (Merzouki et al. 2000). A midwife directed the smoke into the vagina of women who were seeking abortions. The other ingredients were *Cannabis sativa* L., *Conium maculatum* L., *Datura stramonium* L., *Ecballium elaterium* (L.) A. Rich., and *Withania somnifera* (L.) Dunal. Many of the species listed here are poisonous and should never be used by untrained individuals. The pine thistle has also been reported to have insecticidal properties (Jacobson 1958).

***Atriplex canescens* (Pursh) Nutt. (Chenopodiaceae). four-wing saltbush.**

The Jemez of New Mexico threw leaves on fires to generate smoke that was used to revive a badly hurt or faint person (Cook 1930).

***Atriplex obovata* Moq. (Chenopodiaceae). mound saltbush.**

The entire plant was smoked to treat epilepsy by the Hopi of northeastern Arizona (Colton 1974).

***Atriplex* sp. (Chenopodiaceae). saltbush.**

The Cahuilla of southern California smoked dried leaves to relieve head colds (Bean and Saubel 1972).

***Atropa acuminata* Royle ex Lindl. (Solanaceae). Indian belladonna.**

The leaves of this species were smoked in India for their analgesic properties (Kapoor 2001).

***Atropa baetica* Wilk. (Solanaceae). tabba.**

The leaf bracts of this species were used in the preparation of a traditional pipe in Morocco, called *kif*, that was smoked for its narcotic effects (Merzouki et al. 2000).

***Atropa belladonna* L. (Solanaceae). deadly nightshade.**

In parts of Ukraine, the leaves of belladonna were mixed with those of jimsonweed (*Datura stramonium* L.) and those of black henbane (*Hyoscyamus niger* L.) and were smoked for the relief of asthma (Kondratyuk et al. 1967). These are all highly poisonous plants and should never be used by untrained individuals.

***Atropa mandragora* L. (Solanaceae). mandrake.**

This species was one of the many whose use was implicated in inducing psychic visions in the Delphic oracle, or Pythia, of ancient Greece (Stefanis et al. 1975). The plant may have been burned below the Pythia's prophetic chamber (*manteion*) and vented up through the small hole in the famous *omphalos* stone on which the Pythia's tripod stool was fastened.

***Atylosia lineata* Wight. & Arn. (Fabacaeae). rantur.**

The dried leaves of rantur were smoked in pipes in western Maharashta State, India, for the relief of asthma (Tosh 1996).

***Austrobrickellia patens* (Don. ex Hook and Harm) R. M. King & H. Rob. (Asteraceae). chorochikea.**

The whole plant was burned over charcoal by the Izoceño-Guaraní of Bolivia. The smoke from the plant was believed to reduce fevers (Bourdy et al. 2004).

***Avena sativa* L. (Poaceae). oat.**

The seeds were burned for fumigants that were used in Hungary to keep insects away from houses and animals (Vajkai 1943).

***Avicennia germinans* (L.) Stearn (Verbenaceae). black mangrove.**

According to the Darien of Panama, the wood of this species makes an effective smoke smudge that repels mosquitoes (Duke 1968).

***Avicennia marina* (Forssk.) Vierh. (Verbenaceae). gray mangrove.**

The leaves of this mangrove are considered useful for repelling or killing *Culex quinquefasciatus* mosquitoes according to Thangam and Kathiresan (1992). The country of use was not specified.

***Avicennia nitida* Jacq. (Verbenaceae). white mangrove.**

Asita and Campbell (1990) reported that the wood of the white mangrove could be burned to produce smoke that effectively inhibited three species of bacteria—*Staphylococcus aureus, Saccharomyces cerevisiae,* and *Eschirichia coli*—all of which are known to spoil food. It also may have been used to drive away mosquitoes.

***Azadirachta indica* A. Juss. (Meliaceae). neem.**

The binomial botanical name of neem literally means "bitter tree from India." The vernacular name, neem, is from the Sanskrit word *nimba*, meaning "sprinkling of nectar and ambrosia" (Lewis and Elvin-Lewis 2003). Neem is used for a variety of purposes, many of which were recognized by the Indians and Chinese as early as 4,000 years ago. This species produces several active compounds, of which the tetranotriterpenoid, azadirachtin, is an active insecticide. In Ghana and Gambia, the leaves of the neem tree were burned to produce smoke that repels mosquitoes (Aikins et al. 1994). This was true of other parts of East Africa, especially where the Bantu language of Swahili was spoken (Heine and Legére 1995). Smoke from burning leaves was also used in the rural villages of the Oio region of Guinea-Bissau, in West Africa, to drive mosquitoes away (Pålsson and Jaenson 1999b). According to Medvei (1993), Hindus may have used vaginal fumigations of neem trees as contraceptives. Along with 16 other plant species, this species was listed in the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.) as an ingredient in a deadly concoction that, when burned, produced smoke that was lethal to animals (Sensarma 1998). The other plants include *Butea monosperma* (Lam.) Taub. in Engl. & Prantl, *Careya arborea* Roxb., *Ferula assa-foetida* L., *Gossypium herbaceum* L., *Holarrhena antidysnterica* L., *Hordeum vulgare* L., *Lufta echinata* Roxb., *Moringa oleifera* Lam., *Ocimum* sp., the broken grains of *Oryza sativa* L., *Paspalum scrobiculatum*., *Populus euphratica* Oliv., *Ricinus communis* L., *Salvadora indica* Royle., and *Xeromphis spinosa* (Thunb.) Keay.

***Baeckea frutescens* L. (Myrtaceae). Baeckea.**

Smoke from burning dried plants was inhaled to treat violent colic in Southeast Asia (Pételot 1953; van Duong 1993). Patients usually reclined on a lattice bed under which the plant was burned. They inhaled the smoke as it passed over them.

***Balanites aegyptiaca* (L.) Del. (Balanitaceae). desert date.**

In Chad, Africa, the whole plant was burned and used as a fumigant for liver problems (Watt and Breyer-Brandwijk 1962). The Borana of Ethiopia fumigated their milk containers with smoke from the burning of this plant (Heine and Brenzinger 1988). The Ethiopian name for the species is *báddan*. In Ghana,

smoke from burning bark was used to heal circumcision wounds (Dalziel 1948; Irvine 1961).

***Balanites gillettii* Cufod. (Balanitaceae). kuze.**

The Samburu of Kenya fumigated and cleansed their gourds and containers with the smoke of burning wood (Heine and König 1988a).

***Balanites orbicularis* Sprague. (Balanitaceae). Balanites.**

In Kenya, the Turkana (Morgan 1981) and Samburu (Heine and König 1988a) used the smoke of burning fruits to preserve their gourds. The Turkana also used the smoke to give flavor to their milk (Morgan 1980).

***Balanites rotundifolia* (Tiegh.) Blatter. (Balanitaceae). hankalta.**

The Samburu of Kenya used the wood to fumigate and cleanse their gourds and containers (Heine and König 1988a).

***Balanites welwitschii* (Tiegh.) Exell & Mendonça (Balanitaceae). omumbamenye.**

The Himba of Namibia burned the dried roots of this plant on glowing embers and used the smoke as a fumigant to treat breast complaints in nursing mothers (von Koenen 2001). *Omumbamenye* is the Himban name for the species.

***Balsamodendron myrrha* T. Nees (Burseraceae). murr.**

According to Avicenna, smoke from burning murr resin was an external fumigant in Iran for general diseases of the skin (Mohagheghzadeh et al. 2006).

***Balsamorhiza sagittata* (Pursh) Nutt. (Asteraceae). balsam root.**

The Crow of North America used balsam root as incense during feather headpiece transfer ceremonies (Hellson 1974). The smoke was also used to disinfect sickrooms or was inhaled for general body aches (Foster and Hobbs 2002).

***Bambusa vulgaris* Schrad. (Poaceae). common bamboo.**

Common bamboo stems were burned in Guyana to generate fumes that were considered useful for repelling mosquitoes (Defillips et al. 2004).

***Banksia dentata* L. f. (Proteaceae). tropical banksia.**

Native Australians on the northern Australian island of Groote Eylandt burned the cones of this species in a pit and then squatted over the smoke so that it passed in and around their anus. This was said to relieve diarrhea (Levitt 1981). They call the plant *enindurrkwa*.

***Barleria waggana* Rendle (Acanthaceae). Qodox tol.**

Fresh aerial parts of this and other species of *Barleria* were burned in Somalia, with the smoke being inhaled as a treatment for chicken pox (Samuelsson et al. 1991).

***Bauhinia fassoglenis* Kotschy (Fabaceae). Mutama.**

Smoke from burning roots was used in parts of South Africa to treat general gynecological disorders (Arnold and Giulumian 1984).

***Bauhinia* sp. (Fabaceae). Bauhinia.**

In the Riau Province of Sumatra, Indonesia, the dried leaves of an unspecified species of *Bauhinia,* known locally as *katuk katuk,* were crushed, rolled into a cigarette, and smoked to treat polyps in the nasal tract (Grosvenor et al. 1995).

***Becium grandiflorum* (Lam.) Pic. Serm. (Lamiaceae). tebub.**

In parts of Zimbabwe, the leaves of tebub were smoked for the relief of chest and abdominal pain (Gelfand et al. 1985).

***Berchemia discolor* Hemsl. (Rhamnaceae). wild almond.**

This species was used to treat menorrhagia in Venda, South Africa. Affected women exposed their vulva to the smoke of burning roots (Arnold and Gulumian 1984).

***Berlandiera lyrata* Benth. (Asteraceae). lyreleaf greeneyes.**

After the dried roots were burned, they were ground up. The powder was then thrown on hot coals. The smoke was inhaled to give one courage and relieve nervousness (Swank 1932).

***Betula nana* L. (Betulaceae). dwarf birch.**

The Alaskan natives of Nelson Island, off the west coast of Alaska, burned the entire shrub to smoke their fish (Ager and Ager 1980).

***Betula papyrifera* Marsh. (Betulaceae). paper birch.**

The Dena'ina of Alaska used the wood to smoke their fish (Kari 1995). Dried rotten wood was used to smoke hides by the Woodland Cree of east-central Saskatchewan, Canada (Leighton 1985). Various other Native Americans chopped new soft wood and mixed it with their tobacco (*Nicotiana* spp.) (Krochmal and Krochmal 1973).

***Betula pumila* L. var. *glandulifera* Regel. (Betulaceae). dog birch.**

The Pillager Obijwa of North America inhaled the smoke of burning cones (on hot coals) to treat catarrh (Smith 1932).

***Betula utilis* D. Don. (Betulaceae). Himalayan birch.**

The papery bark of this birch tree was burned in India (Singh, G. S. 2000) and Nepal for incense and religious purposes (Manandhar 2002).

***Bidens palustris* Sherff. (Asteraceae). waata.**

The Borana of Ethiopia burned this species as incense (Heine and Brenzinger 1988). *Waata* is the Borana name.

***Bidens* sp. (Asteraceae). beggarticks.**

The Borana of Ethiopia burned an unspecified species of *Bidens* as incense (Heine and Brenzinger 1988).

***Bidens pilosa* L. (Asteraceae). hairy beggarticks.**

In parts of western Uganda, the leaves, seeds, roots, and fruits of this species were smoked in a pipe to help induce labor during childbirth (Kamatenesi-Mugisha and Oryem-Origa, 2006).

***Bidens* sp. (Asteraceae). beggarticks.**

The Borana of Ethiopia burned an unspecified species of *Bidens* as incense (Heine and Brenzinger 1988).

***Bidens tripartita* L. (Asteraceae). water agrimony.**

The flower heads, when burned, give off a pleasant aromatic smoke that was used in parts of Europe to repel insects (Cribb and Cribb 1981).

***Biophytum sensitivum* (L.) DC. (Oxaladaceae). life plant.**

In India, the Ratan Mahal Gujarat smoked the leaves (with unspecified *Nicotiana* spp.) to render a man infertile (Bedi 1978).

***Blepharis* sp. (Acanthaceae). ubuhlungu besigcawa.**

The Sukuma tribe of Tanzania (formerly Tanganyika) in East Africa burned an unspecified *Blepharis* plant and then inhaled its smoke to treat smallpox and infected legs (von Reis and Lipp 1982).

***Blumea balsamifera* DC. (Asteraceae). nagi camphor.**

Natives of Indo-China believed that the smoke produced by burning the leaves of *B. balsamifera* was ideal for restoring normal breathing in humans (Kariyone and Kimura 1949). In Malaysia's Kelantan State, where it is known as *sembong,* the roots were smoked for nose sores (Ong and Nordiana 1999).

***Blumea balsamifera* DC. var. *balsamifera* (Asteraceae). sambong.**

In the Cordillera region of the Philippines (northern Luzon), the leaves of this plant were burned on hot coals to generate smoke that was inhaled for the relief of asthma (Co 1989). The leaves were sometimes mixed with those of *Euphorbia hirta* L.

***Boerhavia coccinea* Mill. (Nyctaginaceae). hogweed.**

In parts of Tanzania, the leaves of hogweed were ground with oil and were then burned to produce smoke that was inhaled to treat toothache (von Reis and Lipp 1982).

***Boscia angustifolia* A. Rich. (Capparaceae). sehel.**

Known in the Gourma District of Mali, Africa, as *ajardahan* and *danarehi,* the bark of this species was burned to fumigate the heads of those suffering from headaches (Diallo et al. 1999).

***Boscia angustifolia* A. Rich. var. *angustifolia* (Capparaceae). likwon.**

The Pokot of northern Kenya used the smoke from burning bark as a fumigant to treat sick cows (Timberlake 1987). The Borana of Ethiopia and the Gabbra of Kenya used it to fumigate and cleanse their gourds (Heine and Brenzinger 1988).

***Boscia coriacea* Paz (Capparaceae). kupungur.**

In Kenya, the Turkana (Morgan 1981), Rendille (Heine and Heine 1988b), and Samburu (Heine and König 1988a) all used the smoke produced by burning this species to preserve gourds. The Turkana also used the smoke to fumigate leather containers, especially those in which they stored ghee (clarified butter) (Morgan 1980). They refer to this plant as *erdung*.

***Boscia minimifolia* Chiov. (Capparaceae). Boscia.**

The Borana of Ethiopia and the Gabbra of Kenya burned this plant to fumigate and cleanse their gourds (Heine and Brenzinger 1988).

***Boscia senegalensis* Lam. (Capparaceae). Senegal boscia.**

The wood of this species, when burned as fuel, produces obnoxious smoke (Wickens 2004).

***Boswellia ameero* Balf. f. (Burseraceae). frankincense plant.**

The oleo-gum resins of this species were harvested by the people of the island of Socotra, located approximately 547 km (340 miles) southeast of Yemen, and were burned for incense purposes according to Huwes (1950).

***Boswellia bhau-dajiana* Birdw. (Burseraceae). mohr-add.**

The oleo-gum resin of mohr-add was burned as incense in parts of northeastern Africa (Huwes 1950) and has often traded as as frankincense.

***Boswellia carteri* Birdw. (Burseraceae). olibanum tree (figure 17).**

The oleo-gum resins produced by this species, called frankincense or olibanum, were highly prized throughout the Mediterranean (Huwes 1950), Somaliland, and other parts of the Middle East, including Iran and Iraq (Hooper and Field 1937), for burning as incense (Usher 1974). It has been sold for this purpose in the markets of Jima, Ethiopia, where it is known as *k'eyi it'an* (Siegenthaler 1971). The Jima markets were, at one stage, a principal source of frankincense (Tucker 1986).

***Boswellia dalzielii* Hutch. (Burseraceae). frankincense tree.**

In parts of West Africa, the smoke of burning resin was used to fumigate and perfume clothes (Huwes 1949).

***Boswellia frereana* Birdw. (Burseraceae). African elemi.**

This species' oleo-gum resins were used throughout the Mediterranean (Huwes 1950) and in tropical Africa for incense purposes (Usher 1974).

***Boswellia glabra* Roxb. (Burseraceae). Kundur.**

Gum resin was burned to produce smoke that was used to fumigate the skin for general dermatological diseases according to Avicenna (Mohagheghzadeh et al. 2006).

***Boswellia hildebrandtii* Engl. (Burseraceae). elemi frankincense.**

The Pokot of northern Kenya burned the resin on their fires because the aromatic smoke it produced repelled insects (Timberlake 1987). The local name for this species is *songoluwo*. The Rendille of the Marsabit District of northern Kenya considered the dead wood from this species good incense material and therefore burned it during certain ceremonies as well as in their houses (Heine and Heine 1988b). This was also a common practice of the Turkana of northern Kenya, who called this plant *ekinyate* (Morgan 1980).

Figure 17. *Boswellia carteri*. © 1995–2006 Missouri Botanical Garden.

***Boswellia microphylla* Chiov. (Burseraceae). frankincense tree.**

In parts of Nigeria, the resin collected from the bark of this species was burned specifically to fumigate rooms and clothes and was often exported as frankincense (Oliver 1960).

***Boswellia neglecta* S. Moore. (Burseraceae). dakkara.**

This species generated income for the farmers of rural households in Liban, Ethiopia, where the oleo-gum resins were burned for incense purposes, perfumery, food and beverage flavoring, and traditional medicine (Lemenih et al. 2003).

***Boswellia ogadensis* Voll. (Burseraceae). gended.**

This species generated income for farmers in the rural households of Liban, Ethiopia. The oleo-gum resins were burned for incense purposes (frankincense), perfumery, food and beverage flavoring, and traditional medicine (Lemenih et al. 2003).

***Boswellia papyrifera* Hochst. (Burseraceae). elephant tree.**

The highlanders of Ethiopia harvested the olibanum resin from the bark of this species and burned it to produce smoke, which was inhaled to control fever. It was also reputed to have a tranquilizer effect (Wilson and Mariam 1979). Some Ethiopians burned it at night to ward off evil spirits (Getahun 1976). It was used in East Africa (Usher 1974) and in northeastern Africa (Huwes 1950), where it was considered useful for burning as incense. A combination of factors, including overgrazing, poor harvesting practices, and insect infestations, are threatening populations of this species and may now require the implementation of urgent conservation practices to save the plant (Gebrehiwot et al. 2003).

***Boswellia sacra* Flueck. (Burseraceae). frankincense.**

In parts of Oman, the smoke generated during the burning of oleo-gum resins harvested from this species was used to perfume clothes, hair, and houses (Ghazanfar 1994). This species was considered the major source of Arabian frankincense during classical times (Tucker 1986).

Boswellia sacra

***Boswellia serrata* Roxb. (Burseraceae). Indian frankincense.**

The oleo-gum resins of this species were harvested and burned as incense in the dry hilly areas of northern India (Huwes 1950; Usher 1974). In the Rajasthan State of India, smoke from burning resin was burned during magico-religious ceremonies that were meant to hasten the recovery of sick people (Singh and Pandey 1998). As part of the ceremony, the smoke was offered to gods and goddesses in the hope that they would drive away bad influences. In the Gwalior Forest division of Madhya Pradesh, India, the bark was smoked through a special censer, called *chilam*, to relieve gastric pain and to pass air (Anis et al. 2000). Dhiman (2003) reported that this species was considered sacred throughout India and was burned in houses as incense, especially during religious ceremonies.

***Boswellia socotrana* Balf. f. (Burseraceae). Socotran incense.**

This was another of the species used on the Island of Socotra for its resin. It was considered ideal for burning as incense (Uphof 1968).

***Boswellia* spp. (Burseraceae). Boswellia.**

Several species of *Boswellia* were burned in saunalike chambers by Borana women in southern Oromia, Ethiopia. The smoke was used to perfume and cleanse their bodies and clothes (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Brassica integrifolia* (H. West) O. E. Schulz. (Brassicaceae). mustard.**

In parts of Africa, sun-dried leaves of this plant were smoked like cannabis (Jayaweera 1980).

***Brassica juncea* (L.) Czern. (Brassicaceae). Indian mustard.**

In India's Indus Valley (Ladakh region), the seeds were mixed with red peppers and placed on hot coals. The resulting smoke was thought to ward off the evil eye and other spirits from children and cattle (Singh et al. 1996).

***Brassica rugosa* Prain (Brassicaceae). cabbage-leaf mustard.**

The Kumaon of India burned the seeds of this species with capsicum to produce smoke that was used to induce lactation in domestic animals that failed to lactate naturally (Shah and Joshi 1971).

***Breynia vitis-idaea* (Burm. f.) C. E. C. Fisch. (Euphorbiaceae). kattuniruri.**

When the people of Rayalaseema in Andhra Pradesh, India, suffered from sore throats, they would burn the leaves of this species under a blanket, where they also sat, and inhaled the smoke through their mouth (Nagaraju and Rau 1990).

***Bridelia cathartica* Bertol. f. (Euphorbiaceae). knobbly blue sweetberry.**

This species was used in Zimbabwe, where smoke from burning roots was inhaled to treat epilepsy (Gelfand et al. 1985). Women villagers in Lumbwa in Tanzania's

Tanga District inhaled smoke of the burning wood to help with menstruation (Watt and Breyer-Brandwicjk 1962).

***Bridelia scleroneura* Müll. Arg. (Euphorbiaceae). Musasila.**

Men of Bulamogi County, Uganda, smoked the leaves of this plant when they wanted to divorce their wives (Tabuti et al. 2003).

***Brucea antidysenterica* J. F. Mill. (Simaroubaceae). Waginos.**

Smoke from burning roots was inhaled by Ethiopians for the treatment of general gynecological disorders (Mohagheghzadeh et al. 2006).

***Brugmansia* spp. (Solanaceae). Brugmansia.**

Several species of *Brugmansia* were used in South America, where the leaves were added to tobacco (*Nicotiana* spp.) and given to women and slaves to smoke. This deadened their senses prior to being buried alive with their dead husbands or masters (Avery 1959). The *Brugmansia* genus is closely related to the *Datura* genus.

***Brugmansia suaveolens* (Willd.) Bercht & C. Presl (Solanaceae). angel's trumpet.**

In the Cordillera region of northern Luzon in the Philippines, dried flowers were chopped up and then smoked in cigarette form during the onset of asthma attacks (Co 1989). In Cyprus, where the name for the plant is *fouskes,* dried leaves and petals were smoked in cigarettes also for the relief of asthma (Georgiades 1987b).

***Brunfelsia guianensis* Benth. (Solanaceae). Impukiu.**

Smoke from burning branches was smoked for its hallucinogenic properties in parts of French Guiana (Defilipps et al. 2004).

***Bryonia dioica* Jacq. (Cucurbitaceae). white bryony.**

According to ancient Egyptian texts, this plant was burned with another unidentified species to drive demons away (Manniche 1989).

***Buddleja asiatica* Lour. (Buddlejaceae). bai bei feng.**

Unspecified parts of this species were burned in Pinatubo in the Philippines as a fumigant for babies who cried for extended periods or were unable to sleep (Fox 1953).

***Bulbostylis* spp. (Cyperaceae). hair sedges.**

The Kuanyama Ango of Angola burned several species of hair sedges and inhaled the smoke to aid recovery following childbirth (Loeb et al. 1956).

***Bulnesia sarmientoi* Lorentz ex Griseb. (Zygophyllaceae). palo santo.**

In northwestern Argentina, the Criollos burned wood chips of this species with the leaves of *Ruta chalepensis* L. and blew the smoke into the ears of patients suffering from otitis (Scarpa 2004). A mixture of parts of palo santo, yerba mate (*Ilex paraguariensis* A. St-Hil.), and feathers of the flightless bird, *Rhea americana,* was smoked to treat aire (Scarpa 2004). The mixture was smoked once a day for 9 days.

***Bursera bipinnata* Engl. (Burseraceae). copal.**

The copal resin produced by this species was collected by the Huichol of Mexico's Jalisco and Nayarit States and was burned as incense (Bauml 1994).

***Bursera glabrifolia* Engl. (Burseraceae). linaloe.**

Smoke from smoldering resin was considered useful as a remedy for headaches in Mexico (Martínez 1990). Ximenez (1615) reported that the same smoke could also treat illnesses caused by cold and humid conditions.

***Bursera graveolens* Triana & Planch. (Burseraceae). palo santo.**

The Maya of Mexico, Belize, and Guatemala may have used the fumes of burning palo santo (holy tree) resin to treat hemorrhoids and to help expel a dead fetus

from its mother (Rätsch 2004). In the Gulf of Mexico, the Huaxtec added the resin to their tobacco (*Nicotiana* spp.), giving it a pleasant smell.

***Bursera gummifera* L. (Burseraceae). mastic tree.**

The Maya of Mesoamerica prized this species for burning as incense. The plant parts used were not specified (Usher 1974).

***Bursera microphylla* A. Gray (Bursercaeae). elephant tree.**

According to the Seri of Mexico, the dried wood of this species was the best plant material for smoking out bees so that their honey could be safely collected (Felger and Moser 1985).

***Bursera simaruba* (L.) Sarg. (Burseraceae). palo mulatto.**

The Maya of Mexico's Yucatán Peninsula burned the resin obtained from this species as incense during certain ceremonies (Stross 1997). On the small Caribbean island of Montserrat, the resin of the palo mulatto was burned for smoke that was used during voodoo practices (Brussell 1997).

***Bursera* spp. (Burseraceae). Bursera.**

The smoke of burning resin, tapped from several *Bursera* species, was considered useful for relieving headaches (Martínez 1990). The Chorti Maya of Guatemala used the smoke to purify venison. The incense was thought to drive away the evil in the carcass (Wisdom 1940). The amount of resin burned in the offering was decided by the deer god, which appeared in the hunters' dreams. Once the right amount had been communicated to the hunter, the resin had to be burned at midnight on the night after the hunt. The Chorti also allowed the fumes to pass over the bodies of their people because it was considered useful for driving away evil from humans and for cleansing them after they had been in contact with sick people (Wisdom 1950). The smoke of burning resin was also used in connection with hunting by the Sierra Popoluca of the isthmus of Tehuantepec (Foster 1945). It was burned with the jawbones of the hunted animals to help return their soul to the spirit world.

***Bursera submoniliformis* Engl. (Burseraceae). copal de Puebla.**

Mexican shamans added the resin of this species to unspecified parts of *Datura innoxia* Mill. and *Tagetes lucida* Cav. and burned the mixture to protect them from black magic (Rätsch 2004). If inhaled deeply, the fumes may induce hallucinogenic visions.

***Bursera tomentosa* Triana and Planch (Burseraceae). copal.**

The Zinacantecos of Mexico burned the copal resins from this species (Tzotzil pom) to make offerings to their gods (Laughlin 1975).

***Butea monosperma* (Lam.) Taub. in Engl. & Prantl (Fabaceae). Bengal kino.**

This species is listed in the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya* as one of several ingredients in a mixture burned to produce smoke to blind one's enemies (see recipe 2 under *Asparagus racemosus* Willd.) (Sensarma 1998). See also *Nerium odorum*.

***Buxus hyrcana* Pojark. (Buxaceae). Shemshad.**

The leaves were considered useful in Iran for generating smoke that could help with toothache (Ghorbani 2005).

***Cadaba farinosa* Forsk. ssp. *farinosa* (Capparaceae). worm bush.**

The Pokot of northern Kenya believed that by burning the roots of this species the smoke generated would prevent or stop earthquakes (Timberlake 1987).

***Cadaba ruspoli* Gilg. (Capparaceae). cadaba.**

The Rendille of Kenya's Marsabit District fumigated their containers with the smoke generated by burning this species (Heine and Heine 1988b).

***Caesalpinia bonduc* (L.) Roxb. (Fabaceae). yellow nicker.**

The people of Santhal Pargana, India, smoked powdered yellow nicker seeds to relieve colic pain (Varma et al. 1999).

***Caesalpinia erianthera* Chiov. (Fabaceae). Caesalpinia.**

Dried plant powder was thrown on smoldering charcoal to produce a fragrant smoke that was used to perfume and air-out a person's living quarters and body in the Dhofar region of southern Oman (Miller and Morris 1988).

***Calamintha nepeta* (L.) Savi (Lamiaceae). lesser calamint.**

The leaves of the lesser calamint were used in the preparation of smoke that was inhaled to aid in digestion in the upper Lucca Province of Italy (Pieroni 2000).

***Calea zacatechichi* Schltdl. (Asteraceae). Mexican dreamherb.**

This species was used by the Chontal of Mexico to treat fevers and nausea. It was also considered useful to communicate with spirits (MacDougall 1968; Díaz 1979).

***Callicarpa cana* L. (Verbenaceae). garwew.**

The leaves of this plant were smoked in the Philippines to relieve asthma (van Duong 1993).

***Callirhoë involucrata* A. Gray. (Malvaceae). winecup.**

The Dakota of North America pulverized the roots of this species, which they then burned to produce smoke that was inhaled for treating head colds (Uphof 1968; Usher 1974).

***Callitris glaucophylla* J. Thomson & L. A. S. Johnson. (Cupressaceae). white cypress pine.**

Indigenous Australians inhaled the smoke of burning twigs as aromatherapy for babies (Latz 1995). According to Barr (1993), the smoke from the leaves and branches was also useful in treating adult respiratory problems.

***Callitris intratropica* R. T. Baker & H. G. Sm. (Cupressaceae). cypress pine.**

The Native Australians of Groote Eylandt used the smoke from burning cypress pine gum with dry *Pandanus* sp. nuts (Pandanaceae) to repel mosquitoes (Levitt 1981). It was also used as a permanent contraceptive. A woman wishing to prevent future pregnancies squatted over a pit in which the plant material was burning, allowing the smoke to pass around her vagina. The local name for this species is *yimundungwa*.

***Calophyllum inophyllum* L. (Clusiaceae). Alexandrian laurel.**

In the former Tanzanian area of Tanganyika in East Africa, the leaves were pounded, mixed with the sap of young leaves and oil, and then cooked in a fire so that the fumes could be inhaled by people possessed by the devil (von Reis and Lipp 1982).

***Calotropis gigantea* (L.) W. T. Ait. (Asclepiadaceae). crown flower.**

Known in Fiji as *madar,* smoke from burning wood was inhaled to treat epilepsy (Singh 1986). In India's Gujarat State, smoke from burning dried roots was inhaled for the relief of migraine headaches (Mitaliya et al. 2004). In Malaysia, smoke from burning leaves was inhaled to treat ulcers in the nose (van Duong 1993).

***Calotropis procera* (Ait.) W. T. Ait. (Asclepiadaceae). rooster tree.**

Calotropis procera

In Bodio, Mali, a psychiatric healer claimed that the fruit pulp, when laid on glowing coals, could treat epilepsy (Coppo 1978). In Egypt, the natives of the Kharga and Dakhla Oases smoked dried leaves for asthma (Osborn 1968). They were also smoked in a pipe for the relief of coughs (Neuwinger 1994). Smoke from burning dried roots was inhaled for the relief of migraine headaches in India's Gujarat State (Mitaliya et al. 2004). In Nepal, dried stems were smoked in cigarettes to cure sinusitis (Bhattarai 1993). In the Awaran area between Khuzdar and Nal in southern Pakistan, the people smoldered powdered roots over hot coals and inhaled the smoke to relieve headaches (Goodman and Ghafoor 1992). The Hausa tribe of Nigeria smoked the leaves in a pipe or inhaled fumes from burning leaves during asthma attacks (Dalziel and Burkhill 1985).

***Calyptrocarya poeppigiana* Kunth (Cyperaceae). Wuh-luh-puh-te-guh.**

In Suriname, smoke generated by burning the complete plant was inhaled to reduce fever (Defilipps et al. 2004).

***Cananga odorata* (Lam.) Hook. f. and Thomson (Annonaceae). ilang-ilang.**

The people of Java, Indonesia, burned unspecified parts of this plant for incense purposes (Sangat-Roemantyo 1990).

***Canarium amboinense* Hochr. (Burseraceae). galip nut.**

The resin of this species was harvested by the people of Java, Indonesia, and was often burned as incense (Uphof 1968).

***Canarium commune* L. (Burseraceae). Java almond.**

The resin of Java almond was burned in parts of Malaysia for incense purposes (Uphof 1968; Usher 1974).

***Canarium edule* Hook. f. (Burseraceae). African plum.**

The people of tropical Africa burned resin harvested from the bark for incense purposes (Uphof 1968).

***Canarium harveyi* Seem. (Burseraceae). canarium nut.**

The oleoresin extracted from the oily kernels of this species was once prized as lighting oil and incense in Vanuatu (Siwatibau et al. 1998) and in the Solomon Islands (Evans 1999).

***Canarium indicum* L. (Burseraceae). Java almond.**

In Indonesia, smoke from the resin of this species was considered a powerful fumigant that was used to cleanse areas where illnesses had occurred (Heyne 1950).

***Canarium indicum* L. var. *indicum* (Burseraceae). Java almond.**

The resin collected from this species was burned in traditional ceremonies and churches in parts of Melanesia (Thomson and Evans 2004).

***Canarium luzonicum* Miq. (Burseraceae). pili nut.**

This Old World elemi resin was burned in the Philippines as incense. It produces a smoky flame when burned (Brown 1921).

***Canarium schweinfurthii* Engl. (Burseraceae). Schweinfurth's olive.**

The resin from the bark of this plant was harvested and then burned to fumigate dwellings in unspecified countries (Langenheim 2003). The fragrant resin burns with an odor like that of the related frankincense resins of *Boswellia* spp.

***Canarium strictum* Roxb. (Burseraceae). black dammar tree.**

The resin of this species was burned to produce smoke that was considered useful for repelling insects in Mizoram State, India (Lalramnghinglova 2003).

***Canarium sylvestre* Gaertn. (Burseraceae). kenari jalene.**

Stem resin was burned throughout the Malayan archipelago for incense purposes (Uphof 1968).

***Canarium zeylanicum* Blume (Burseraceae). kekuna.**

The balsamic gum resins obtained from injured or damaged bark was burned in Sri Lanka to fumigate and to light houses (Jayaweera 1981a).

***Canella alba* Murr. (Canellaceae). white cinnamon.**

This species has been smoked as a substitute for *Cannabis sativa* L. and sometimes has been used as incense (Rätsch 2004). The country and users were not reported.

***Canella winterana* Gaertn. (Canellaceae). winter cinnamon.**

Chipped wood was burned to produce smoke that was inhaled to treat headaches in several of the islands and areas of the West Indies (Ayensu 1981).

***Canna indica* L. (Cannaceae). Indian shot.**

In parts of China, the leaves were burned for their insecticidal properties (Perry 1980).

***Cannabis sativa* L. (Cannabinaceae). hemp.**

Cannabis has been smoked throughout the world for centuries, and one of its first uses was for incense purposes (Clarke 1998). Indian yogis at various temples in Kathmandu, Nepal, smoked cannabis in preparation for meditation (Schultes et al. 2001). It is, however, best known for its hallucinatory properties. Members of the Gaddi tribe of India's Himachal Pradesh State in the western Himalayas, for example, smoked the resin of female plants, called *sulpha*, for the hallucinations it induced (Singh and Kumar 2000). In the Buganda kingdom of Africa, members of the tribe smoked the leaves and flowers of cannabis to induce a state of euphoria (Hamill 2001). The leaves were smoked for similar purposes by the people of Kanabad village and allied areas in the Gilgit District of Pakistan (Gorsi and Miraj 2002). The ancient Assyrians are thought to have used cannabis as a fumigation to dispel sorrow or grief (Manniche 1989). Littleton (1986) has suggested that the fumes of burning hemp may have induced psychic visions in ancient Greece's Delphic oracle. The leaves may have been mixed with those of the bay laurel, *Laurus nobilis* L. The Tenetehara of Brazil smoked the flowers and the leaves for their psychoactive effects (Wagley and Galvão 1949). The species also has a number of medicinal properties. In Africa, the Sotho smoked the leaves and other parts of the male and female plants to relieve the pains associated with childbirth (Watt and Breyer-Brandwijk 1962). In Morocco, midwives used the smoke of cannabis and other species to induce abortions in pregnant women wishing to terminate their pregnancies (see *Atractylis gummifera* L.; Merzouki et al. 2000). In the Democratic Republic of Congo (Zaire), children with asthma were forced to inhale the smoke from burning leaves to relieve the condition (Disengomoka et al. 1983). The Zulu smoked

Cannabis sativa

the leaves of this species with those of *Warburgia salutaris* (Bertol. f.) Chiov. for the relief of dry coughs (Bryant 1966). Another use for cannabis smoke was as an insect repellent. The seeds were burned in Hungary to keep insects away from houses and animals (Vajkai 1943).

***Capparis cartilaginea* Decne. (Capparaceae). caper.**

In the Dhofar region of southern Oman, where the name for this plant is *lúsfeh,* the smoke from smoldering leaves was used as a fumigant for relieving itchiness, watering eyes, and running nose associated with allergies (Miller and Morris 1988).

***Capparis speciosa* Griseb. (Capparaceae). caper.**

The Maka of the Paraguayan Chaco burned the branches of caper to fumigate and heal people who talk in their sleep (Arenas 1987). The smoke was also used as a fumigant to prevent chicken pox epidemics.

***Capparis tomentosa* Lam. (Capparaceae). African caper.**

Known in Venda, South Africa, as *Gwambazi-muoba-dali,* the roots of this species were burned to treat menorrhagia and headaches (Arnold and Gulumian 1984). The smoke was directed over an exposed female's vulva for the former diseases. The smoke was inhaled for the latter. The Lobedu of Africa smoked the bark in a pipe to relieve chest pains (Watt and Breyer-Brandwijk 1962). The roots were smoked in Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Capsicum annuum* L. (Solanaceae). chili pepper.**

This plant was known to the Jívaro of eastern Ecuador as *jímia*. When they wished to punish their children, they forced them to stand over fires into which large quantities of jímia had been thrown (Harner 1984).

***Capsicum frutescens* L. (Solanaceae). red pepper.**

In Benin, Africa, the smoke of this species was used as a fumigant to relieve headaches (Neuwinger 1994). In Aligandi, Panama, red peppers and cacao (see *Theobroma cacao* L.) were burned for 7 to 9 days to produce smoke that was said to keep evil spirits away (Duke 1968). The ancient Maya of Mesoamerica smoked red peppers mixed with tobacco (*Nicotiana* spp.) for the relief of whooping cough (Asprey and Thornton 1955). The smoke has also been employed to repel mosquitoes (Hartzell 1947) and to protect stored grains from insects and other pests (McIndoo 1945).

Capsicum frutescens

***Capsicum* sp. (Solanaceae). red peppers.**

In the West Indies, red peppers were smoked with tobacco (*Nicotiana* spp.) to treat whooping cough and sore throats (Asprey and Thornton 1953, 1954a, 1954b, 1955).

***Carapa guianensis* Aubl. (Meliaceae). bastard mahogany.**

Oil derived from the seeds of bastard mahogany was burned to produce illumination and to drive insects away (Duke 1968).

***Cardiospermum grandiflorum* Sw. (Sapindaceae). showy balloon vine.**

The roots were smoked by the people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Cardiospermum halicacabum* L. (Sapindaceae). Zulu plant.**

Powdered hot leaves of this species, when burned, produced acrid smoke that South Africans inhaled for headaches (Neuwinger 1994).

***Careya arborea* Roxb. (Lecythidaceae). patana oak.**

This species is listed in the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.) as one of several plant ingredients in a recipe burned to produce smoke to blind one's enemies (see *Abrus precatorius* L.) (Sensarma 1998). The mixture also required certain salts and cow dung.

***Carica papaya* L. (Caricaceae). papaya.**

Unspecified parts of this species were often used as a tobacco (*Nicotiana* spp.) substitute in the French island of New Caledonia (South Pacific Ocean) (Watt and Breyer-Brandwijk 1962). In Isthmian America (Mexico to Colombia), the leaves were also smoked in place of tobacco (Duke 1986).

***Carissa edulis* Vahl (Apocynaceae). Egyptian carissa.**

The roots were smoked in parts of Ethiopia for mental disorders (Mohagheghzadeh et al. 2006). In Bulamogi County, Uganda, the leaves were smoked to keep spirits at bay (Tabuti et al. 2003).

***Carissa lanceolata* R. Br. (Apocynaceae). conkerberry.**

Indigenous Australians inhaled the smoke of burning conkerberry leaves to give babies and other members of their tribe strength and endurance for long trips (Webb 1969) or to fumigate sick members of tribe (Webb 1969; Lands 1987). The leaves were also burned to repel insects (Webb 1969; Cane 1987; Lands 1987; Whitman et al. 1991). Native Australians prized many species of plants for smoke therapies.

***Carum carvi* L. (Apiaceae). caraway.**

This species, known as *kömény* in Hungary, was burned for smoke that was inhaled to treat abdominal pains (Oláh 1987) and for babies who cried excessively after their birth (Vajkai 1943).

***Carum copticum* Benth. & Hook. f. (Apiaceae). bishop's weed.**

The smoke of burning seeds was used in Iran to clean a woman's uterus (Mohagheghzadeh et al. 2007). In India, the seeds were sometimes smoked or taken as snuff for the relief of migraine headache or delirium (Williamson 2002). In the latter case, the species was referred to by its synonym, *Trachyspermum ammi* (L.) Sprague ex Turrill.

***Carya cordiformis* C. K. Schneid. (Juglandaceae). bitternut hickory.**

Smoke from the wood of the bitternut hickory was used in parts of North America to flavor hams and bacon (Erichsen-Brown 1979).

***Cassia abbreviata* Oliv. (Fabaceae). sjambok pod.**

This plant was burned by the Swahili-speaking people of East Africa for its smoke, which was used as a fumigant to bewitch other people (Heine and Legére 1995). The plant is known as *mwonge* in East Africa.

***Cassia abbreviata* Oliv. ssp. *beareana* (Holmes) Brenan (Fabaceae). sjambok pod.**

In parts of Namibia, the smoke of smoldering branches was inhaled to treat headaches (von Koenen 2001).

***Cassia fistula* L. (Fabaceae). golden shower.**

The Darien of Panama used the pulp of the fruit of this species to flavor their tobacco (Duke 1968).

***Cassia italica* (Mill.) Spreng. (Fabaceae). sanna.**

Inhaling smoke from burning fruit was considered useful for relieving coughs in Egypt (Mohagheghzadeh et al. 2006).

***Cassia mimosoides* L. (Fabaceae). artillery plant.**

This species, when burned, was said to produce smoke that could attract and promote business in the Swahili-speaking areas of East Africa (Heine and Legére 1995). It is known locally as *kichekanao*.

***Cassia occidentalis* L. (Fabaceae). coffee senna.**

Known locally as *mnukauvundo* by the Swahili-speaking people of East Africa, this plant was burned and used as a fumigant to protect individuals from devils and evil spirits (Heine and Legére 1995).

***Cassia reticulata* Willd. (Fabaceae). saragundi.**

The Bora of Brillo Nuevo in Amazonian Peru once burned the leaves because they produce a pungent smoke that kills and repels small biting insects (Flores 1984). It is rarely used today.

***Cassia sieberana* DC. (Fabaceae). marga.**

The wood of this species, when burned as fuel, produces obnoxious smoke (Wickens 2004). No other details were given.

***Cassine glauca* (Rottb.) Kuntze (Celastraceae). Ceylon tea.**

Smoke produced by burning this plant was used in India to calm women suffering from hysteria (Chopra et al. 1956).

***Cassiope fastigiata* D. Don. (Ericaceae). Cassiope.**

The branches of cassiope were burned as incense in the Manang District of Nepal (Pohle 1990).

***Casuarina oligodon* L. Johnson (Casuarinaceae). sheoak.**

In the highlands of Papua New Guinea, where this species is known as the *naep,* the Wola actively seek its wood to burn as firewood because of the pleasant fragrances emitted along with its smoke (Sillitoe 1983).

***Catabrosa aquatica* P. Beauv. (Poaceae). water whorlgrass.**

The Crow and Montana of North America burned this plant as incense (Barrett and Gifford 1933). This species was reported as *Glyceria aquatica* (L.) Wahlb. in original texts.

***Catoblastus drudei* Cook and Doyle. (Arecaceae). ponila.**

The Bora of Amazonian Peru used the stems of this species to smoke their fish (Vasquez 1990).

***Caulerpa scalpelliformis* (R. Br. ex Turner) C. Agardh. (Caluerpaceae). strapweed.**

According to Thangam and Kathiresan (1992), the smoke from burning leaves of this seaweed killed or repelled mosquitoes (*Culex quinquefasciatus*) when prepared as mosquito coils.

***Ceanothus sanguineus* Pursh. (Rhamnaceae). wild lilac.**

The Paiute of North America dried and mashed the leaves and then mixed them with tobacco (*Nicotiana* spp.), which they smoked for pleasure and other unspecified purposes (Mahar 1953).

***Ceanothus velutinus* Hook. (Rhamnaceae). snowbush.**

The Shuswap of North America used the smoke of burning snowbush to kill bedbugs (Palmer 1975).

***Cecropia obtusifolia* Bert. (Cecropiaceae). guarama.**

The Darien of Panama and others from Mexico to Colombia smoked the leaves and stems of this species for recreational purposes (Duke 1968; Duke 1986).

***Cecropia peltata* L. (Cecropiaceae). trumpet tree.**

In the rain forests of Belize, the leaves were dried, powdered, and then smoked for pleasure by the chicleros and supervisors (Arvigo and Balick 1993). The Darien of Panama and people living in Isthmian America (Mexico to Colombia) also smoked the leaves. The latter often smoked the stems as well (Duke 1968; Duke 1986).

***Cedrus deodara* (Roxb. ex Lambert) G. Don (Pinaceae). deodar cedar.**

According to the Ayurvedic system of India, parts of this plant were dried in the sun and then soaked with ghee before being smoked to relieve asthma (Mishra 2003).

***Cedrus libani* G. Don (Pinaceae). cedar of Lebanon.**

According to Avicenna, Iranians used smoke from burning branches and resin to induce abortions (Mohagheghzadeh et al. 2006). Elsewhere, the pulverized wood was mixed with the herbs and resins of plants of the *Boswellia* and other genera and were burned as incense (Rätsch 2004). Other Cedrus species may have served similar roles. No details about the country of use or its users were given.

***Celmisia spectabilis* Hook. f. (Asteraceae). common mountain daisy.**

The Maori of New Zealand smoked parts of this plant for the relief of asthma and for other lung ailments (Stark 1979).

***Celtis timorensis* Span. (Ulmaceae). ki tondok (Indonesia).**

In parts of India, smoke from burning wood was used as a general fumigant (Chopra et al. 1956).

***Cephaelis williamsii* Standl. (Rubiaceae). Cephaelis.**

In the Putumayo area of Colombia, the people dried the leaves of this species and added them to tobacco (*Nicotiana* spp.) before it was smoked (Schultes 1985a).

***Cestrum laevigatum* Schlect. (Solanaceae). palqui.**

In southern Chile, the Mapuche smoked dried leaves of the palqui when cannabis was not available. It was believed to induce hallucinogenic visions (Schultes et al. 2001).

***Cestrum parqui* L'Her. (Solanaceae). lady of the night.**

Like *Cestrum laevigatum* Schlect., the Mapuche smoked dried leaves of the *dama de noite* (lady of the night) when cannabis was not available (Schultes et al. 2001).

***Chamaecrista nigricans* Greene (Fabaceae). partridge pea.**

Unspecified parts of this plant were smoked by people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Chamaemelum nobile* (L.) All. (Asteraceae). English chamomile.**

The Allioni of Norfolk, Great Britain, burned whole plants to produce smoke that was used for unspecified medicinal purposes (Bardswell 1911). The dried flowering heads, which produce volatile oils, were mixed with tobacco (*Nicotiana* spp.) to add flavor to it (Lewis and Elvin-Lewis 2003).

***Chamaesyce hirta* (L.) Millsp. (Euphorbiaceae). dove weed.**

In Guyana, smoke produced by burning the entire plant was inhaled to treat respiratory complaints (Defilipps et al. 2004).

***Cheilanthes calomendos* Sw. (Adiantaceae). mphasetje.**

Approximately 30 g of root and leaf material was ground into a powder and then burned for smoke that was used in Swaziland to treat epilepsy (Amusan et al. 2002).

***Cheilanthes hirta* Sw. (Adiantaceae). lip fern.**

Smoke from this species was inhaled with *Mohria caffrorum* (L.) Desv. to treat restless children of the Kwena and Tswana of Africa (Watt and Breyer-Brandwijk 1962).

***Chenopodium schraderanum* Schult. (Chenopodiaceae). goosefoot.**

The Samburu of Kenya used the smoke of burning sticks to drive bees away when collecting their honey (Heine and König 1988a).

***Chimaphila umbellata* (L.) W. Bart. (Ericaceae). pipsissewa.**

The dried leaves of this species were smoked for pleasure by the Montana of North America (Hart 1996).

***Chromolaena christieana* (Bak.) R. M. King and H. Rob. (Asteraceae). thoroughwort.**

Known in Paraguay as *typychá pito,* the leaves of this plant were added to tobacco (*Nicotiana* spp.) as a flavoring agent (Schmeda-Hirschmann and Bordas 1990).

***Chrysanthemum cinerariaefolium* Vis (Asteraceae). Dalmatian pellitory.**

The smoke of burning flowers was an effective agent for keeping insects away according to Grieve (1971). This species produces natural insecticidal compounds called *pyrethrins* (Lewis and Elvin-Lewis 2003). The active analogues are pyrethroids. These substances are available commercially and are used widely because they are effective at low doses and exhibit a low level of mammalian and avian toxicity. They are, however, toxic to fish. The active substances resemble DDT in their mechanism of action. They are axonic toxins that cause voltage-regulated sodium channels of their targets to remain open, eventually resulting in paralysis.

Chrysanthemum cinerariaefolium

***Chrysanthemum roseum* Adam (Asteraceae). Persian pellitory.**

Like *C. cinerariaefolium* Vis, the smoke produced by burning the flowers was considered an effective agent for keeping insects away (Grieve 1971). This species was previously known as *Pyrethrum roseum* M. Bieb.

***Chrysothamnus nauseosus* (Pall. ex Pursh) Britton (Asteraceae). rabbitbrush.**

The Cheyenne of North America inhaled the smoke produced when this plant was burned to treat colds (Hart 1981).

***Cichorium intybus* L. (Asteraceae). chicory.**

Known in Arabia as *hindiba* and *hendiban,* the leaves were often burned to produce smoke that repels insects (Ghazanfar 1994).

***Cicuta maculata* L. (Apiaceae). spotted water hemlock.**

The Pillager Ojibwa of North America used the smoke of burning fresh roots to help with hunting (Smith 1932). The Chippewa, also of North America, smoked the seeds together with tobacco leaves as a charm (Densmore 1974).

***Cinnamomum burmannii* (Nees & T. Nees) Blume (Lauraceae). Indonesian cassia.**

The bark of this species was burned for incense purposes in Java, Indonesia (Sangat-Roemantyo 1990). The genus *Cinnamomum* is of economic importance to the human race. Several species have yielded compounds that are valuable, including cinnamon, which is produced in the bark of this and related species.

***Cinnamomum camphora* (L.) T. Nees & C. H. Eberm. (Lauraceae). camphor tree.**

This species was often burned as incense in the Hindu temples of India (Jayaweera 1981b).

***Cinnamomum cassia* Blume (Lauraceae). rough cinnamon bark.**

This plant was sold as incense in the markets of Jima, Ethiopia, where it is known as *birgwed* (Siegenthaler 1971).

***Cinnamomum sintoc* Blume (Lauraceae). sintoc.**

The bark of this species was used in the preparation of incense in Java, Indonesia (Sangat-Roemantyo 1990).

***Cinnamomum* sp. (Lauraceae). cinnamons.**

An unspecified species of *Cinnamomum* was used in various Asian countries for producing smoke that was used to guard against disease (Morozumi 1978).

***Cinnamomum tamala* (Buch.-Ham.) T. Nees & Eberm. (Lauraceae). Indian bark.**

Unspecified parts of this species were used in the Himalayas as spice and incense (Rätsch 2004).

***Cinnamomum verum* J. Presl (Lauraceae). scent of paradise.**

This species has been known since ancient times as the "scent of paradise" and was often burned alone or as a mixture of herbs and resins for incense purposes (Rätsch 2004).

***Cinnamomum zeylanicum* Blume (Lauraceae). cinnamon.**

On a wall in the ancient Egyptian tomb of Queen Nefertari of Thebes, a painting depicts Egyptians burning cinnamon to perfume their clothes and houses (Manniche 1989). This species may have been one of the commodities that the ancient Egyptians favored in addition to frankincense and myrrh. It was believed by many scholars that when Queen Hatshepsut of the eighteenth dynasty sent out her expedition to the fabled "land of Punt" for incense, they also bought back cinnamon and other fragrant woods. Sethos I of the nineteenth dynasty also linked Punt with cinnamon (Manniche 1989).

***Cissus nymphaeifolia* Planch. (Vitaceae). omungayanga.**

In the northwestern corner of Namibia, in Kaokoland, the Hereo-speaking people used the smoke of smoldering roots to reduce swelling in men's testicles (Malan and Owen-Smith 1974; von Koenen 2001).

***Cissus quadrangularis* L. (Vitaceae). veldt grape.**

Smoke from the stems was inhaled in parts of India, where the plant is known as *hajora*, to treat general gastrointestinal disorders (Williamson 2002).

***Cissus rotundifolia* Vahl. (Vitaceae). Arabian wax cissus.**

The leaves of this species were smoked together with those of *Hoslandia opposita* Vahl. (see below) to treat bad breath and to relieve pain in the head and chest (Hedberg et al. 1983).

***Cistus albidus* L. (Cistaceae). white-leaf rockrose.**

The leaves of white-leaf rockrose were dried and then smoked for recreational purposes by the people of Almería, Spain (Martínez-Lirola et al. 1996).

***Citrus sinensis* (L.) Osbeck (Rutaceae). sweet orange.**

In Ghana and Sierra Leone, the peels of oranges were burned to produce smoke that was believed to repel mosquitoes (Aikins et al. 1994).

***Clausena anisata* (Willd.) Hook. f. (Rutaceae). horsewood.**

This species, known in Swahili as *mlakikali*, was used as a general fumigant in parts of East Africa (Heine and Legére 1995). The Zulu of South Africa burned the wood to fumigate newborn babies (Hutchings et al. 1996). In other parts of South Africa, smoke from burning leaves was used as a fumigant to treat furunculosis, swellings, and emaciation (Watt and Breyer-Brandwijk 1962). The Xhosa, also of

Africa, produced smoke from smoldering leaves and made babies inhale it so that they had clear and strong lungs (Watt and Breyer-Brandwijk 1962).

***Cleistocalyx aperculatus* (Roxb.) Merr. & L. M. Perry. (Myrtaceae). water fairy.**

Powdered leaves and bark were smoked to treat sinusitis and colds in Nepal (Manandhar 2002).

***Clematis brachiata* Thunb. (Ranunculaceae). traveler's joy.**

Smoke from the burning of leaves was used in Botswana to treat blood problems due to itchy sores (Gelfand et al. 1985). Fresh leaves were smoked in Venda, South Africa, to treat headaches (Arnold and Gulumian 1984).

***Clematis denticulata* Vell. (Ranunculaceae). cabelo del angelo.**

The Izoceño-Guaraní of Bolivia burned the aerial parts of this species over fire and inhaled the smoke to treat malaria (Bourdy et al. 2004).

***Clematis flammula* L. (Ranunculaceae). fragrant clematis.**

In Italy, the leaves and buds of this and other *Clematis* species were smoked as a tobacco (*Nicotiana* spp.) substitute (Leporatti and Ivancheva 2003).

***Clematis recta* L. (Ranunculaceae). ground virgin's bower.**

In Italy, the leaves and buds of this and other *Clematis* species were smoked as a tobacco (*Nicotiana* spp.) substitute (Leporatti and Ivancheva 2003).

***Clematis simensis* Fresen. (Rananculaceae). Umunkamba.**

Smoke from burning leaves is reported to have analgesic properties according to the people of Burundi (Mohagheghzadeh et al. 2006).

***Clematis vitalba* L. (Ranunculaceae). old man's beard.**

In northwestern Anatolia, Turkey, a piece of branch was smoked like a cigarette to relieve toothache (Yeşilada et al. 1999). Dried leaves were smoked in southern Italy's Cilento National Park for their mildly hallucinogenic properties (Scherrer et al. 2005). In other parts of Italy, the leaves and buds were smoked as a tobacco (*Nicotiana* spp.) substitute (Leporatti and Ivancheva 2003).

***Clematopsis scabiosifolia* Hutch. (Ranunculaceae). shock headed Peter.**

The roots of this species were burned in conjunction with others to treat tuberculosis in northern and eastern Mozambique (Verzár and Petri 1987). The patient dried the plant parts and placed the mixture on glowing coals. The patient was then covered with a blanket and forced to inhale the smoke. The other species in the mixture were *Aspilia mossambicensis* (Oliv.) Willd., *Clerodendron discolor* Becc., *Helichrysum kirkii* Oliv. & Hiern., and *Ozoroa reticulata* (Baker f.) R. Fern & A. Fern.

***Clerodendron discolor* Becc. (Lamiaceae). glorybower.**

The roots of this species were used in conjunction with others to treat tuberculosis in northern and eastern Mozambique (Verzár and Petri 1987). See *Clematopsis scabiosifolia* Hutch.

***Clerodendrum indicum* Kuntze (Lamiaceae). bharangee.**

In Java, Indonesia, the people smoked the leaves for the relief of asthma (Hartwell 1982).

***Clerodendrum inerme* (L.) Gaertn. (Lamiaceae). embrert.**

The smoke of burning leaves was reported to have antimosquito properties against Aedes aegypti (Kathiresan and Thangam 1986).

***Clerodendrum myricoides* R. Br. ex Vatke (Lamiaceae). blue glorybower.**

The Borana of Ethiopia and Gabbra of Kenya inhaled the smoke of burning roots to relieve headaches (Heine and Brenzinger 1988).

***Clusia lechleri* Rusby (Clusiaceae). attorney.**

The dried latex of this species was sold in the markets of La Paz and El Alto, Bolivia. Smoke from burning latex was inhaled to treat *susto* ("fright illness") in babies and to bring them good luck (Macía et al. 2005).

***Clusia palmicida* Rich. ex Planch. & Triana (Clusiaceae). kariyik.**

Usher (1974) reported that this species was burned in South America as incense, but no other details were given.

***Clusia* sp. (Clusiaceae). attorney.**

The Waimiri Atroari of Brazil dried the flowers of an unspecified species of *Clusia* and then smoked them to relieve pain and fever (Milliken et al. 1992).

***Clutia abyssinica* Jaub. & Spach (Euphorbiaceae). mhende.**

Known as *mhende* in Tanzania, the whole plant was burned there to produce smoke that was inhaled to treat a variety of gynecological disorders (Hedberg et al. 1983).

***Cnidium cnidifolium* (Turcz.) Schischk. (Apiaceae). wild parsley.**

Smoke smudges made with the leaves were used in the Ft. Yukon region of Alaska to emit a pleasant aroma (Holloway and Alexander 1990).

***Cocculus* sp. (Menispermaceae). lac.**

According to the Ayurveda of India, parts of lac were macerated, smeared with ghee, and then rolled into a cigarette that was smoked to relieve asthma (Mishra 2003).

***Cocos nucifera* L. (Arecaceae). coconut.**

Powdered coconut shells were used in the preparation of incense in Java, Indonesia (Sangat-Roemantyo 1990). Coconut oil was used to make aromatic candles that were burned as incense in Vietnam, Cambodia, and Laos (van Duong 1993). In both Papua New Guinea (Vernede et al. 1994) and the Solomon Islands (Dulhunty et al. 2000), the smoke of burning coconut husks was used to repel mosquitoes. Mosquito smudges of husks were prepared in Isthmian America (Mexico to Colombia) (Duke 1986).

***Codiaeum variegatum* (L.) Juss. (Euphorbiaceae). garden croton.**

The Swahili-speaking people of East Africa burned this plant, known locally as *ndoadoa,* and used its smoke as a general medicinal fumigant (Heine and Legére 1995).

***Coffea arabica* L. (Rubiaceae). Arabian coffee.**

Eischen and Vergara (2004) tested the smoke of burning coffee on the honeybee (*Apis mellifera*) and tracheal mite (*Acarapsis woodi*). It exhibited low but statistically significant mortality.

***Colophospermum mopane* (J. Kirk ex Benth.) J. Léonard. (Fabaceae). mopane.**

The Kwanyama Ovambo of Ovamboland in Namibia smoldered dried leaves over hot coals to produce smoke that drove away evil spirits, especially those that caused bad dreams in persons of nobility (Rodin 1974; Rodin 1985).

***Colquhounia coccinea* Wall. (Lamiaceae). sano tusare.**

The leaves and flowers were burned as incense in Nepal (Manandhar 2002).

***Combretum adenogonium* Steud. ex A. Rich. (Combretaceae). four-leaved bushwillow.**

Sudanese women burned this species to produce smoke to scent their bodies (Wickens 2004).

***Combretum ghasalense* Engl. & Diels. (Combretaceae). dalo.**

The wood was burned in the Sudan for its scented smoke (Usher 1974).

***Combretum imberbe* Wawra (Combretaceae). leadwood.**

The leaves of this species were smoked in southern Africa to treat colds and coughs (Watt and Breyer-Brandwijk 1962).

***Combretum molle* R. Br. ex G. Don. (Combretaceae). velvet bushwillow.**

The Borana of Ethiopia and Gabbra of Kenya burned dried branches to fumigate and cleanse the inside of their milk containers (Heine and Brezinger 1988).

***Combretum quadrangulare* Kurz (Combretaceae). sangke.**

In Papua New Guinea, the stems and branches produced smoke that was useful for the postpartum treatment of mothers (Kerr 1932).

***Combretum zeyheri* Sond. (Combretaceae). large-fruited bushwillow.**

Dried leaves were smoked to cure coughs in the Misima village located in the Handeni District of Tanzania (Kokowaro 1976).

***Commiphora abyssinica* Engl. (Burseraceae). Abyssinian myrrh.**

This plant was sold as incense in the markets of Jima, Ethiopia, where it is known as *kerbe* (Siegenthaler 1971).

***Commiphora africana* (A. Rich.) Engl. (Burseraceae). African bdellium.**

Smoke from burning resin was inhaled by the villagers of Pongwe in the Tanga District of Tanzania, where the fumes were said to be antiseptic and useful for relieving migraine headaches (Kerharo and Adam 1974). They were also used as insecticides. In the Gourma District of Mali, the people produced the smoke to divert evil forces and sorcery and to treat general diseases (Diallo et al. 1999). The resin was burned to fumigate clothes in parts of Nigeria (Oliver 1960).

***Commiphora anglosomaliae* Chiov. (Burseraceae). myrrh.**

This genus is best known for its production of oleo-gum resins called myrrh. This species was sometimes passed off as true myrrh because of similarities in their aromas (Tucker 1986).

***Commiphora boiviniana* Engl. (Burseraceae). hagar-medow.**

The Borana of Ethiopia and the Gabbra of Kenya burned the dried bark on hot coals as incense (Heine and Brenzinger 1988). In Somalia, newborn babies were made to inhale the smoke of burning bark to strengthen them (Neuwinger 1994).

***Commiphora corrugata* Gillett & Vollesen. (Burseraceae). siltaachoo.**

The smoke generated in saunalike chambers was used to perfume and cleanse the bodies and clothes of Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Commiphora erythraea* Engl. (Burseraceae). opopanax.**

This species was considered the principal source of myrrh in ancient and classical times (Tucker 1986). Smoke generated in saunalike chambers in the huts of Borana women in southern Oromia, Ethiopia, was used to perfume and cleanse their bodies and clothes (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Commiphora erythraea* Engl. var. *glabrescens* (Burseraceae). agarsuu.**

This species was commonly burned in Somaliland, where the scented wood and bark were considered useful for burning as incense (Uphof 1968; Usher 1974).

***Commiphora gileadensis* (L.) C. Chr. (Burseraceae). balsam of Gilead.**

This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora guidottii* Chiov. ex Guidotti (Burseraceae). scented myrrh.**

Known in Somalia as *hadi*, its dried bark was burned to fumigate newborn babies to give them strength (Samuelsson et al. 1991).

***Commiphora habessinica* (Berg.) Engl. (Burseraceae). medigeh in Arabia.**

The resin of this *Commiphora* species was burned in parts of Arabia for its smoke, which was inhaled to cure breathing difficulties, chest colds, and swollen glands (Ghazanfar 1994).

***Commiphora hildebrandtii* Engl. (Burseraceae). myrrh.**

This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora kataf* Engl. (Burseraceae). East Indian myrrh.**

This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora madagascariensis* Jacq. (Burseraceae). Abyssinian myrrh.**

The resins from this species were once a principal source of Abyssinian myrrh and were burned for incense purposes (Tucker 1986).

***Commiphora molmol* Engl. ex. Tschirch. (Burseraceae). African myrrh.**

This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora mukul* Engl. (Burseraceae). Indian bdellium.**

In Iran, smoke from burning gum resin was used to purify the air (Mohagheghzadeh et al. 2006). In India, fumes from burning resin, stems, and leaves were prescribed in Ayurveda—India's traditional healing system—for hay fever, nasal catarrh, laryngitis, bronchitis, and phthisis (Williamson 2002). This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora myrrha* Engl. (Burseraceae). myrrh.**

The resin of this species (Harobol myrrh) was burned as incense in Arabia, Somaliland, and Ethiopia (Uphof 1968; Usher 1974). Morton (1977) has reported that the smoke of burning resin was inhaled for fever. This species has generated income for farmers in rural households in Liban, Ethiopia. The oleo-gum resins were burned for incense purposes (myrrh), perfumery, flavoring food and beverages, and use in folk medicine (Lemenih et al. 2003).

***Commiphora opobalsamum* Engl. (Burseraceae). Mecca myrrh.**

In parts of Arabia, the resin of this species was referred to as "Mecca myrrh" and was used extensively for incense purposes (Uphof 1968).

***Commiphora pedunculata* Engl. (Burseraceae). myrrh.**

Manniche (1989) reported that this species, which was common in eastern Sudan and Ethiopia, may have been one of the priceless incense commodities brought back from ancient Egyptian expeditions to the fabled land of Punt and may have been used in various religious ceremonies.

***Commiphora schimperi* Engl. (Burseraceae). myrrh.**

This species was sometimes sold as myrrh (*C. myrrha* [Nees] Engl.) because its smoke has smells similar to true myrrh (Tucker 1986).

***Commiphora* sp. (Burseraceae). myrrh.**

The oleo-gum resins of an unspecified species of *Commiphora* also generated income for farmers in rural households in Liban, Ethiopia, where they were burned

for incense purposes (myrrh), perfumery, food and beverage flavoring, and folk medicines (Lemenih et al. 2003).

***Commiphora truncata* Engl. (Burseraceae). Commiphora.**

This species has generated income for farmers in the rural areas of Liban, Ethiopia. The oleo-gum resins were burned for incense purposes (myrrh), perfumery, food and beverage flavoring, and medicinal purposes (Lemenih et al. 2003).

***Commiphora wightii* (Arn.) Bhandari. (Burseraceae). Indian bdellium tree.**

In the arid plains of northern India, an exudate from this plant, probably a resin, was burned for its smoke, which was inhaled to relieve asthma (Shah 1982). The people of Rajasthan, India, used the fumes of burning resin to drive evil spirits away and to please their gods (Singh and Pandey 1998). The species was considered sacred throughout India, where it was often burned as incense during holy occasions (Dhiman 2003). The Bengali name for the plant is *guggul*. Near Bella in Pakistan, the gum was burned on hot coals to produce noxious smoke that kept snakes away (Goodman and Ghafoor 1992).

***Comptonia peregrina* (L.) Coult. (Myricaceae). sweet fern.**

The Potawatomi of North America prepared a smoke smudge of the leaves of this species to keep mosquitoes away (Smith 1933). This species was reported as *Myrica asplenifolia* L. in original texts.

***Conioselinum scopulorum* Coult. and Rose (Apiaceae). Rocky Mountain hemlock parsley.**

The Kayenta Navajo of North America smoked the plant to treat catarrh (Wyman and Harris 1951).

***Conium maculatum* L. (Apiaceae). poison hemlock.**

In Morocco, this species was one of several ingredients used in a polyherbal recipe that was burned to produce smoke that was considered useful for inducing abortions in pregnant women (Merzouki et al. 2000). See *Atractylis gummifera* L. for a list of the other species used.

***Consolida regalis* Gray (Ranunculaceae). forking larkspur.**

Aerial parts of this species were prepared as a fumigant to treat sick people in Hungary (Kóczián and Szabó 1990).

***Conzya incana* Willd. (Asteraceae). arfaj.**

In Saudi Arabia, the leaves were burned to produce an insect repellent smoke (Ghazanfar 1994).

***Conzya podocephala* DC. (Asteraceae). Conzya.**

The Sotho of Africa burned parts of this plant as fumigants to treat a variety of illnesses (Watt and Breyer-Brandwijk 1962).

***Conyza scabrida* DC. (Asteraceae). oondbos.**

This species was used for purposes similar to *C. podocephala* DC. by the Sotho people of Africa (Watt and Breyer-Brandwijk 1962).

***Cordia goetzei* Gürke (Boraginaceae). mpamapama.**

According to the Digo on Kenya's coast, the firewood of this species, when burned, caused nose wounds (Pakia 2005). *Mpamapama* is the Kenyan name for this species.

***Cordia sinensis* Lam. (Boraginaceae). gundi.**

The smoke from burning wood was used by the Rendille of Kenya to fumigate and cleanse their milk containers (Heine and Heine 1988b). It was used for similar purposes by the Borana of Ethiopia and by the Gabbra of the Marsabit District of Kenya (Heine and Brenzinger 1988).

***Coriandrum sativum* L. (Apiaceae). Chinese parsley.**

In Iran, Afghanistan, and India, the fruits of Chinese parsley were smoked to relieve toothache (Hooper and Field 1937). In Libya, the smoke was inhaled to relieve headaches and to add flavor to smoking tobacco (*Nicotiana* spp.) (Hussein 1985).

***Cornus alternifolia* L. f. (Cornaceae). alternate leaved dogwood.**

The Menomini of North America smoked the inner bark of this species on its own for pleasure or mixed it with tobacco (*Nicotiana* spp.) (Smith 1923). It was usually toasted before it was smoked. The Potawatomi, also of North America, smoked the bark obtained from twigs (Smith 1933). The Ojibwa smoked the bark in their kinnikinnick mixtures (Smith 1932).

***Cornus amomum* Mill. (Cornaceae). silky dogwood.**

The Hocak (formerly known as the Winnebago) of North America smoked the bark of silky dogwood for recreational purposes (Kindscher and Hurlburt 1998). The Dakota (Gilmore 1913a; Gilmore 1919), Menomini (Smith 1923), Omaha (Gilmore 1913b), Pawnee (Gilmore 1919), and Ponca (Gilmore 1919) also smoked the bark alone or mixed it with tobacco (*Nicotiana* spp.).

***Cornus canadensis* L. (Cornaceae). bunchberry dogwood.**

The Hoh and Quileute of North America smoked dried leaves for pleasure (Reagan 1936).

***Cornus florida* L. (Cornaceae). flowering dogwood.**

Dried bark was mixed and smoked with tobacco (*Nicotiana* spp.) by the Micmac and Montagnais of North America (Speck 1917).

***Cornus foemina* Mill. (Cornaceae). stiff dogwood.**

The bark of this species, which has been reported as *C. stricta* in original texts, was dried and then mixed with tobacco (*Nicotiana* spp.) and smoked for pleasure (Speck 1917).

***Cornus occidentalis* (Torr. & Gray) Coville (Cornaceae). western dogwood.**

The Hoh and Quileute of North America smoked the plant for pleasure (Reagan 1936). Moerman (1998) has suggested that the species actually smoked was probably *Cornus sericea* L. ssp. *occidentalis* (Torr. & Gray). Fosberg.

***Cornus paniculata* L'Hér. (Cornaceae). gray dogwood.**

The Meskwaki of North America burned the bark to produce smoke that was inhaled for treating consumption and for reviving patients (Densmore 1974). It was also smoked as ceremonial tobacco (Smith 1928). The Ojibwa of North America peeled and toasted the twig bark to mix with their tobacco (*Nicotiana* spp.) (Smith 1932).

***Cornus pubescens* Nutt. (Cornaceae). western dogwood.**

The Thompson of North America smoked this plant for pleasure (Steedman 1928). Moerman (1998) has suggested that the species actually smoked was probably *Cornus sericea* L. ssp. *occidentalis* (Torr. & Gray). Fosberg.

***Cornus racemosa* Lam. (Cornaceae). panicled dogwood.**

The Hocak (Winnebago) of North America smoked the bark for recreational purposes (Kindscher and Hurlburt 1998). The Ojibwa, also of North America, smoked the leaves in their kinnikinnick mixtures (Smith 1932).

***Cornus rugosa* Lam. (Cornaceae). roundleaf dogwood.**

The Hocak of North America smoked the bark for recreational purposes (Kindscher and Hurlburt 1998). The Chippewa smoked parts of the entire plant for that purpose (Densmore 1928).

***Cornus sericea* L. (Cornaceae). redosier dogwood.**

The Cree of Hudson Bay in North America smoked scrapings from the wood with tobacco (*Nicotiana* spp.) in their kinnikinnick mixtures (Millspaugh 1974).

***Cornus sericea* L. ssp. *occidentalis* (Torr. and Gray). Fosberg. (Cornaceae). western dogwood.**

The Hoh and Quileute of North America smoked the plant for pleasure (Reagan 1936). It was reported as *C. occidentalis* (Torr. & Gray) Coville. The Thompson used it for similar purposes (Steedman 1928) but was reported as *C. pubescens* Torr. in the original texts.

***Cornus sericea* L. ssp. *sericea* (Cornaceae). wedosier dogwood.**

Many North American tribes smoked the bark of this species either alone or mixed it with tobacco (*Nicotiana* spp.). These include the Malecites, who also smoked the plant to treat headaches and catarrh (Mechling 1959), Ojibwa, Abnaki, Blackfoot, Cheyenne (Hart 1981), Cree (Beardsley 1941), Dakota (Gilmore 1919), Gosiute (Chamberlin 1911), Great Basin tribes (Nickerson 1966), Montana (Blankinship 1905), Okanagan-Colville (Turner et al. 1980), Omaha (Gilmore 1919), Shoswap (Palmer 1975), Thompson (Steedman 1928; Perry 1952), and Washoe (Nickerson 1966). This species was reported as *Cornus stolonifera* Michx. in the aforementioned references.

***Cornus stolonifera* Michx. (Cornaceae). red stem dogwood.**

The Chippewa of North America smoked parts of this plant in a pipe for unspecified purposes (Densmore 1974). Moerman (1998) suggests that the species actually used was probably *Cornus sericea* L. ssp. *occidentalis* (Torr. & Gray) Fosberg. The inner bark was also smoked with and without tobacco (*Nicotiana* spp.) by various Native North American tribes (Lewis and Elvin-Lewis 2003). Other unspecified parts were mixed with tobacco and smoked ceremonially for smoke prayer (Grinnell 1923). See also *Cornus sericea* L. ssp. *sericea* (Moerman 1998).

***Cornus stricta* Lam. (Cornaceae). stiff-cornel dogwood.**

The bark of this species was dried and then mixed with tobacco (*Nicotiana* spp.) and smoked for pleasure (Speck 1917). Moerman (1998) suggests that the species actually used was probably *Cornus foemina* Mill.

***Corydalis aurea* Willd. (Papaveraceae). scrambled eggs.**

Native North Americans used the smoke of burning roots to revive unconscious patients (Foster and Hobbs 2002). The Ojibwa placed the roots on hot coals and inhaled the smoke to clear the head (Smith 1932).

***Corylus avellana* L. (Corylaceae). common filbert.**

The leaves were smoked all over Eurasia for unspecified purposes (Lewis and Elvin-Lewis 2003).

***Corymbia citriodora* (Hook.) K. D. Hill & L. Johnson (Myrtaceae). citron scent gum.**

The leaves of this species, when burned, were reported to repel mosquitoes in western Kenya, Africa (Seyoum et al. 2003).

***Cotoneaster microphyllus* Wall. ex. Lindl. (Rosaceae). xiao ye xun zi.**

The leaves were burned for incense purposes in Nepal (Manandhar 2002).

***Cotoneaster vulgaris* Lindl. (Rosaceae). common cotoneaster.**

In India's Lahoul Valley, members of various tribes smoked green cotton, made by thrashing the leaves of this species with a stick, for pleasure (Sood et al. 2001) and as incense (Aswal and Mehrotra 1987).

***Couratari multiflora* (Sm.) Eyma. (Lecythidaceae). tauari.**

The Palikur and Wayãpi of French Guiana used the inner bark of this species to wrap their cigars. This was also thought to give the cigars narcotic properties (Grenand et al. 1987).

***Cousinia thomsoni* C. B. Clarke (Asteraceae). cousinia.**

The people of the cold desert Mooling and Losar tribes of India's Lohoul-Spiti area (northwestern Himalayas) smoked the cottonlike threads of the leaves of this *Cousinia* species for pleasure (Sood et al. 2001).

***Coutarea pterosperma* Standl. (Rubiaceae). coparche.**

The Tepehuana of Chihuahua, Mexico, have harvested the resins from this species to burn as incense (Pennington 1969).

***Covillea glutinosa* Rydb. (Zygophyllaceae). creosote bush.**

The Papago of North America used smoke from smoldering green branches to treat sore feet (Castetter and Underhill 1935). The limbs were held above the smoke. Moerman (1998) suggests that the species actually used may have been *Larrea tridentata* Coville var. *tridentata*.

***Crabbea velutina* S. Moore (Acanthaceae). Crabbea.**

In Bulamogi County, Uganda, smoke generated by burning the whole plant was inhaled to protect people from losing a job or to help overcome a criminal case (Tabuti et al. 2003).

***Crataegus oxyacantha* L. (Rosaceae). hawthorn.**

The young leaves of this species were sometimes smoked as a tobacco (*Nicotiana* spp.) substitute (Lewis and Elvin-Lewis 2003). The country of origin was not specified.

***Crataegus pruinosa* (Wendl.) K. Koch. (Rosaceae). frosted hawthorn.**

The Flambeau Ojibwa of North America smoked the bark of the frosted hawthorn to attract deer while hunting (Smith 1932).

***Crataegus* sp. (Rosaceae). hawthorn.**

The Flambeau of North America used the smoke of an unidentified hawthorn to attract deer (Smith 1932).

***Crossopteryx kotschyana* Fenzl. (Rubiaceae). Crossopteryx.**

The seeds were burned as a fumigant to treat bark cloth in an unspecified part of the world (Usher 1974).

***Crotalaria aculeata* De Wild. (Fabaceae). Kasamba ndege.**

Leaves were smoked by the people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Crotalaria glauca* Willd. (Fabaceae). Lweto.**

In Bulamogi County, Uganda, smoke generated by burning the entire plant was inhaled to protect people from losing a job (Tabuti et al. 2003).

***Croton dichogamus* Pax (Euphorbiaceae). rocky ground croton.**

The leaves of this species were smoked in parts of tropical Africa to treat a condition known locally as *satura,* which is a type of malnutrition (Kokowaro 1976). The leaves were also dried and burned to fumigate people with high fevers. The Sakuma of tropical Africa smoked the leaves in cigarettes that were meant to treat chest and stomach complaints. In Tanzania, the leaves were smoked to treat respiratory complaints (Hedberg et al. 1983).

***Croton eluteria* Sw. (Euphorbiaceae). cascarilla.**

The bark was burned as a fumigant that was considered useful for repelling mosquitoes (McIndoo and Sievers 1924) and for other unspecified purposes (Vogel 1970).

***Croton flavens* L. (Euphorbiaceae). balsam.**

In the Caribbean island of Montserrat, the leaves of this species, when dried, were smoked to relieve congestion of the lungs and as a tobacco (*Nicotiana* spp.) substitute (Brussell 1997).

***Croton flocculosus* Geisel. (Euphorbiaceae). bitter balsam.**

Like *C. flavens* L., the dried leaves of this species were used to treat lung ailments in Montserrat (Brussell 1997).

***Croton gratissimus* Burch. (Euphorbiaceae). lavender croton.**

Known in some places as *cascarilla*, the ground leaves of this species were smoked by the Zulu of South Africa for insomnia (Palmer and Pitman 1972). In Zimbabwe, they were smoked for the relief of coughs (Gelfand et al. 1985).

***Croton pseudopulchellus* Pax. (Euphorbiaceae). mpasho.**

Kokowaro (1976) reported that in certain parts of tropical Africa the leaves of this species were burned to fumigate crops to protect them from insects. In the Nunge and Chalinze villages of the Bagamuyo District of eastern Tanzania, dried leaves were dipped in coconut oil and then placed on a fire. The resultant smoke was inhaled to reduce fever (Chhabra et al. 1990). The leaves were burned as incense in areas of East Africa, where Swahili is the main language (Heine and Legére 1995).

***Croton texensis* (Klotzsch) Müll.-Arg. (Euphorbiaceae). Texas croton.**

The Ramah Navajo of North America burned this plant and used the smoke to rid their clothes of the smell of skunk (Vestal 1952).

***Croton tiglium* L. (Euphorbiaceae). croton oil plant.**

In parts of Southeast Asia, oil obtained from this species was used for illumination, even though its fumes are considered noxious in confined spaces (Burkill 1994).

***Croton zambesicus* Müll. Arg. (Euphorbiaceae). fever berry.**

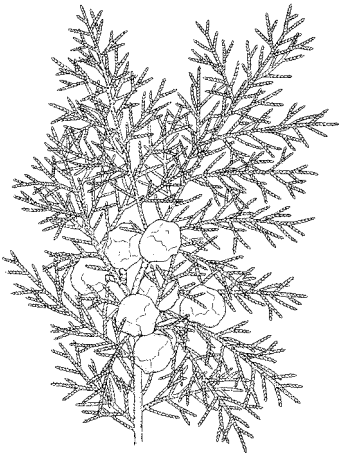
The So of Uganda burned the twigs of this species near their plant fields to hasten the ripening of crops (Heine and König 1988b).

***Cryptomeria japonica* D. Don. (Taxodiaceae). tsugi pine.**

The leaves of the tsugi pine were burned in Nepal for incense purposes (Manandhar 2002; Usher 1974).

***Cupressus arizonica* Greene (Cupressaceae). Arizona cypress.**

Native North Americans burned the leaves for fumes that were inhaled to aid with childbirth, for removing afterbirth, for shrinking the womb, and for increasing urinary flow (Krochmal and Krochmal 1973).



Cupressus arizonica

***Cupressus lusitanica* Mill. (Cupressaceae). cedar of Goa.**

In Bulamogi County, Uganda, unspecified parts of this plant were smoked to keep spirits at bay (Tabuti et al. 2003).

***Cupressus torulosa* D. Don. (Cupressaceae). Himalayan cypress.**

The leaves of this gymnosperm were burned and used as incense in Nepal (Manandhar 2002).

***Curcuma domestica* Valeton (Zingerberaceae). turmeric.**

Known in Indonesia as *kakoenji* and *koenjat,* the tubers of this species were burned to produce a fumigant that was said to promote mucus retention in people with colds and runny noses (Hirschhorn 1983). In parts of Sri Lanka, dried turmeric leaves were burned to generate smoke that was inhaled to treat catarrh and headaches (Jayaweera 1982b).

***Curcuma longa* L. (Zingerberaceae). Indian saffron.**

In the Marquesas Islands, the smoke generated by this plant, when burned, was blown into a woman's vagina if she was experiencing prolonged menstruation (Ross 2003).

***Cuscuta reflexa* Roxb. (Convolvulaceae). giant dodder.**

In Nepal, smoke produced by burning the whole plant was inhaled to reduce fever (Shrestha and Dhillion 2003).

***Cycnium racemosum* Benth. (Scrophulariaceae). Cycnium.**

The Zulu of South Africa used smoke from the burning of the leaves of this plant as fumigations to pass over animals to be slaughtered during ritual sacrifices (Watt and Breyer-Brandwijk 1962).

***Cydista aequinoctialis* Miers. (Bignoniaceae). garlic vine.**

The people of Livingston, Izabal, in Guatemala harvested resins from the dried bark of this species and burned them to generate smoke that was used as an insect repellent (Pöll et al. 2005).

***Cydonia oblonga* Mill. (Rosaceae). quince.**

The latex of this plant was burned to produce smoke that was inhaled in parts of Iran for general gastrointestinal disorders (Mohagheghzadeh et al. 2006).

***Cymbopetalum brasiliense* Benth. (Annonaceae). katjoesi anjali.**

In parts of Suriname, where this species is known as *katjoesi anjali*, the leaves were smoked to relieve stomachache (Defilipps et al. 2004).

***Cymbopogon bombycinus* (R. Br.) Domin. (Poaceae). silky oil grass.**

In the Northern Territory of Australia, the aerial parts of this plant were mixed with parts of termite mounds and smoked for the postnatal care of newborn babies (Barr 1993).

***Cymbopogon caesius* (Hook. & Arn.) Stapf (Poaceae). broad-leaved turpentine grass.**

The Pokot of northern Kenya burned this plant to produce scented smoke that was inhaled by girls who had recently been circumcised (Timberlake 1987).

***Cymbopogon citratus* Stapf (Poaceae). oil grass.**

Whole plants were burned green or dry in houses in Gabon, Africa, to drive away mosquitoes (Walker and Sillans 1961 cited in Burkill 1994).

***Cymbopogon densiflorus* Stapf (Poaceae). lemon grass.**

In the African nation of Malawi, the flowers of lemon grass were smoked in a pipe for the relief of bronchial illnesses (Burkill 1994). The shamans of Tanzania smoked the flowers either alone or mixed them with tobacco (*Nicotiana* spp.) to induce dreams that helped them foretell the future (Schultes et al. 2001).

***Cymbopogon giganteus* Chiov. (Poaceae). tsauri grass.**

In Nigeria, smoke fumigations prepared from burning roots were inhaled for relieving migraine headaches and for treating sick horses (Dalziel 1937). The Socé of Senegal used fumigations from unspecified parts of the plant to treat lumbago (Kerharo and Adam 1964b cited in Burkill 1994).

***Cymbopogon jwarancusa* (Jones) Schultes (Poaceae). iwarancusa grass.**

The smoke produced by this plant was used to drive away evil in parts of Pakistan (Gilani et al. 2003).

***Cymbopogon marginatus* Stapf ex Burtt Davy (Poaceae). dobo grass.**

In South Africa's Venda area, the roots of this species were burned to generate smoke that was inhaled for the relief of headaches (Arnold and Gulumian 1984).

***Cymbopogon nardus* (L.) Rendle. (Poaceae). citronella grass.**

The oil produced by this species, known commonly as citronella, has been burned traditionally in Southeast Asia and elsewhere as a mosquito repellent (Chomchalow 1993).

***Cymbopogon proximus* (Hochst. ex A. Rich) Stapf (Poaceae). halfa barr.**

The tufts of this plant were smoked in Algeria for the relief of colds (Mohagheghzadeh et al. 2006).

***Cymbopogon* sp. (Poaceae). lemon grasses.**

Herders in Niger, Africa, pounded this grass together with tobacco (*Nicotiana* spp.) and burned the mixture to fumigate and treat sick cattle (Maliki 1981 cited in Burkill 1994).

***Cynoglossum boreale* Fern. (Boraginaceae). hound's tongue.**

The Ojibwa of North America burned the entire plant on hot coals and directed the smoke up the nostrils of unconscious people to revive them (Smith 1932).

***Cyprus articulatus* L. (Cyperaceae). jointed flatsedge.**

In parts of Africa, smoke from burning roots was used to fumigate the body during sickness (Dalziel 1937).

***Cyprus bulbosus* Vahl. (Cyperaceae). galingale.**

The roots and tubers of this species are very fragrant and were often burned for incense purposes in the Maldive Islands (von Reis and Lipp 1982).

***Cyprus rotundus* L. (Cyperaceae). nutgrass.**

The smoke produced by burning nutgrass was used in China as a fumigant to treat deep-seated wounds (Vidal 1961).

***Cyprus* sp. (Cyperaceae). flatsedges.**

Heine and Legére (1995) reported that an unspecified *Cyprus* species was used in the preparation of incense sticks in East Africa, where its local name is *muudiudi*. The plant parts used were unspecified.

***Cytisus canariensis* (L.) Kuntze (Fabaceae). genista.**

In parts of northern Mexico, Yaqui shamans smoked the dried flowers of genista for their psychoactive effects (Fadiman 1965).

***Cytisus scoparius* (L.) Link (Fabaceae). Scotsbroom.**

In the Scottish highlands, tips of Scotsbroom were burned to use as fumigants for unspecified purposes (Maloney 1972).

***Dalbergia junghuhnii* Benth. (Fabaceae). Dalbergia.**

The heartwood of thick stems was burned as incense by an unspecified group of people in China and India (Uphof 1968).

***Dalbergia parviflora* Roxb. (Fabaceae). akar laka.**

The wood was burned throughout the Malay Archipelago for its scented smoke (Uphof 1968).

***Dalbergia picta* (H. Karst.) Wiehler. (Fabaceae). rosewood.**

The Secoya of eastern Ecuador burned the leaves of this species to produce smoke that was used to treat boils (Schultes and Raffauf 1990). They also smoked the leaves for unspecified recreational purposes (Vickers and Plowman 1984).

***Daniella oliveri* (Rolfe) Hutch. & Dalz. (Fabaceae). sanya.**

Pållsson and Jaenson (1999b) have suggested that the smoke produced during the burning of the bark of this species can reduce biting by mosquitoes by more than 70%.

***Daphne bholua* Buch.-Ham. ex D. Don (Thymelaeaceae). Lokta.**

The bark of this species was smoked to treat respiratory tract disorders in the highlands of Dolakha District, Nepal (Shrestha and Dhillion 2003).

***Daphniphyllum humile* Maxim. ex Franch. & Sav. (Daphniphyllaceae). Daphniphyllum.**

In Japan, the Ainu smoke the leaves in place of tobacco (*Nicotiana* spp.) (Lewis and Elvin-Lewis 2003).

***Datura fastuosa* L. (Solanaceae). devil's trumpet.**

Smoke from burning leaves was considered a useful remedy for relieving headaches and asthma according to the Zulu of South Africa (Gerstner 1941). This was also a common practice in Zanzibar, Africa (Usher 1974). Tribal members of the Western Ghats in the Kerala area of India, in contrast, burned dried flowers and inhaled their smoke to relieve asthma (Pushpangadan and Atal 1984). Both the leaves and dried flowers were smoked during asthma attacks and for other breathing difficulties in the Dhofar region of southern Oman (Miller and Morris 1988). The Dhofar Arabic name for the species is *benj*. In southern Pakistan, the smoke of six to seven burning seeds was used as a fumigant to rid oneself of parasites (Goodman and Ghafoor 1992). In Yemen, the smoke was inhaled to relieve cramps, epileptic fits, and insomnia (Miller and Morris 1988).

Datura fastuosa

***Datura ferox* L. (Solanaceae). fierce thorn apple.**

The Criollos of Chaco in northwestern Argentina smoked the dried leaves for their antiasthmatic properties (Scarpa 2004). They also mixed dried leaves with tobacco (*Nicotiana* sp.), smoked the mixture, and then blew the smoke into the ears of sufferers of otitis (Scarpa 2004). To complete the cure, the ear was sealed with iguana fat and wool from a black sheep. The leaves of this species were also smoked to treat asthma in India (Dessanges 2001). This practice was later introduced into Europe by an English general who was posted in Madras and was himself an asthmatic. *Datura stramonium* L. was more common in Europe and was therefore smoked instead of *D. ferox*.

***Datura innoxia* Mill. (Solanaceae). prickly burr.**

The Sansi of India's Davsa District in the state of Rajasthan (Sharma and Trivedi 2004) and natives of the sub-Himalayan region of eastern Uttar Pradesh, India (Singh, A. K. 2000), smoked the seeds and leaves of this species to relieve asthma. This was also common in Vietnam, Cambodia, and Laos (van Duong 1993).

In northern India, this species, known as *dhatura*, was considered very sacred. Its leaves were smoked with tobacco (*Nicotiana* sp.) to relieve asthma and stomach troubles (Shah 1982). The Kumaon Indians smoked the seeds for the relief of gum troubles such as pyorrhea (Shah and Joshi 1971). The seeds and leaves were smoked with tobacco for pleasure in the Awaran area of southern Pakistan (Goodman and Ghafoor 1992). Small doses were said to induce euphoria, but large doses led to madness. The smoke was also used to drive away parasites.

***Datura metel* L. (Solanaceae). Hindu datura.**

This species has been used throughout the world for a variety of purposes. In Cyprus, where the name for the species is *zornés,* dried leaves were smoked for the relief of asthma (Georgiades 1987a). They were smoked for the same purpose by the people of the Tirunelveli District of India's Tamil Nadu State (Thomas and De Britto 2000) as well as in other parts of India (Pandey 1991; Lewis and Elvin-Lewis 2003; Sharma, N. K. 2004), Fiji (Singh 1986), East Africa (Williams 1949), and Myanmar (Mason 1850). In Nepal, both the flowers and leaves were smoked to treat asthma (Manandhar 2002). In addition to relieving asthma, the Zulu of South Africa smoked the plant as a remedy for headaches (Gerstner 1941). Its smoke also found use as a cough suppressant by the people of Ratan Mahal, Guiarat, India (Bedi 1978), where it was considered a sacred plant (Dhiman 2003), and in East Africa (Kokowaro 1976). The Chinese smoked the flowers to prevent coughing and for shortness of breath (Perry 1980). The stems, dried leaves, and sometimes the flowers were smoked to relieve respiratory congestion in Tanzania and other parts of East Africa (Weiss 1979; Chhabra et al. 1993). The seeds of this plant were crushed, mixed, and smoked with tobacco (*Nicotiana* sp.) to relieve toothache in Riau Province, Sumatra, Indonesia (Mahyar et al. 1991). The Satar tribe of Nepal smoked the fruit for the relief of toothache (Siwakoti and Siwakoti 2000; Manandhar 2002). Hindu datura was one of several ingredients in an ancient Sanskrit recipe that reportedly produced smoke that caused blindness to one's enemies (see recipe 1 under *Asparagus racemosus* Willd.) (Sensarma 1998).

***Datura meteloides* DC. ex Dunal (Solanaceae). devil's weed.**

The Costanoan of North America burned the leaves and inhaled the smoke as a purgative (Bocek 1984). Smoke from the seeds, when mixed with tobacco (*Nicotiana* spp.), was thought to be an aphrodisiac (Bocek 1984). Ramah Navajo hunters, also of North America, mixed the plant with pollen and smoked it to "tame" tobacco (Vestal 1952). Other Native North Americans smoked the leaves to relieve shortness of breath (Krochmal and Krochmal 1973).

***Datura* sp. (Solanaceae). thorn apple.**

In the Bahamas, West Indies, the leaves and flowers of an unspecified *Datura* species were smoked for the relief of asthma and influenza (Higgs 1974).

***Datura stramonium* L. (Solanaceae). jimsonweed.**

Throughout the world, the inhalation of smoke generated by burning jimsonweed leaves and other parts of this plant was considered an excellent treatment for asthma. This includes the natives or tribal members of Minas Gerias, Brazil (Hirschmann and Rojas de Arias 1990); Costa Rica (Santamaría 1942); Fiji (Singh 1986); Hawaii (Hope et al. 1993); Haiti (Weniger et al. 1986); Hungary (Kóczián 1985); Trivandum Forest division in Kerala, India (John 1984); Rewalsar, India (Sood and Thakur 2004); Israel (Dafni and Yaniv 1994); Salerno, Italy (De Feo and Senatore 1993); Sardinia, Italy (Jacobs 1997); Jamaica (Asprey and

Datura stramonium

Thornton 1954a); Mexico (Santamaría 1942); Namibia (von Koenen 2001); Nepal's Central Development Area (Joshi and Edington 1990); Peru (Ramirez et al. 1988); Tanzania (Chhabra and Uiso 1991); Tibet (Tsarong 1986); Turkey (Sezik et al. 1992); and Zimbabwe (Nyazema 1984; Gelfand et al. 1985). In other unspecified parts of the world, jimsonweed leaves were often mixed with those of black henbane (*Hyoscyamus niger* L.) and belladonna *(Atropa belladonna* L.) and smoked to relieve asthma (Kondratyuk et al. 1967). The leaves were smoked by the Bakiga and Baganda people of the Kabale District of Africa's Buganda kingdom to treat asthma, sore throat, and stomachache (Hamill 2001). In South Africa, the leaves were rolled up and smoked to relieve asthma and bronchitis (Watt and Breyer-Brandwijk 1962; Iwu 1993; Hutchings and van Staden 1994). This was also common in Norfolk, Britain (Hatfield cited in Allen and Hatfield 2004) and in the Arrabida Natural Park area of Portugal (Novais et al. 2004). Various Arab tribes of Saudi Arabia also smoked the leaves for sinus infections (Abulafatih 1987) as did the Transkei of South Africa (Hutchings et al. 1996). The Zulu of South Africa considered the smoke of burning leaves ideal for treating headaches and asthma (Gerstner 1941). They were also used for that purpose in Zimbabwe (Hillocks 1998). Jimsonweed was believed to be a sacred plant in parts of India, where its leaves were smoked to induce narcosis (Dhiman 2003) and to relieve coughs (Tierra 1983). In northern India, where this species is known as *dhatura* and is also considered very sacred, its leaves were smoked with tobacco (*Nicotiana* sp.) to relieve asthma and stomach troubles (Shah 1982). In Turkey's Sakarya Province, the leaves were smoked for treating bronchitis (Uzun et al. 2004). In Hungary, the smoke of burning seeds and stems was used to relieve toothache, diarrhea, and bleeding (Oláh 1987). That smoke was also considered useful for ridding oneself of parasites according to the people of southern Pakistan (Goodman and Ghafoor 1992). Six to seven seeds were smoked for that purpose. Along with several other plant species (see *Atractylis gummifera* L. for a list), jimsonweed was burned to produce smoke that was used to induce abortions in Morocco (Merzouki et al. 2000). The shamans, or *dumbus*, of the Shuhi, a Tibeto-Burman ethnic group that lives exclusively in the Shuiluo Valley of southwestern China, used the smoke of burning seeds against toothache (Weckerle et al. 2006). The leaves were smoked for asthma and respiratory failure in Mizoram, India (Sharma et al. 2001). Its use as an hallucinogenic agent was also reported. Native North Americans and many other tribes and people smoked the leaves for these purposes (Krochmal and Krochmal 1973), including the Cherokee of North America, the Marie Galente of the Caribbean (Honeychurch 1986), and people of the Appalachians (Krochmal et al. 1969). Jimsonweed smoke was also claimed, at one stage, to have induced psychic visions in ancient Greece's Delphic oracle (Stefanis et al. 1975). This is a very poisonous plant and should not be used by untrained individuals. Its use for many of the aforementioned purposes has been banned in several countries.

***Datura wrightii* Regel (Solanaceae). sacred thorn apple.**

The plant was mixed with pollen and smoked by the Ramah Navajo of North America to calm deer during hunting expeditions (Vestal 1952).

***Delonix regia* (Bojer) Raf. (Caselpiniaceae). flamboyant tree.**

In parts of Africa, Muslims burned the bark of this species as incense when praying (Heine and Legére 1995). The smoke also masked any bad odors in rooms where dead people lay.

***Dendranthema nubigenum* (Wall. ex. DC.) Kitam. ex Kitam. & Gould (Asteraceae). ice plant.**

Powdered leaves were considered useful for burning as incense in Nepal (Manandhar 2002).

***Desmodium adscendens* (Sw.) DC. (Fabaceae). hardstick.**

The Nyindu of the eastern part of the Democratic Republic of Congo (formerly Zaire) burned this species, the smoke of which may have been used as a medicine to induce sunny weather (Yamada 1999). This species has many common names, including zarzabacoa galana.

***Desmodium supinum* DC. (Fabaceae). wild pinder.**

In parts of Jamaica, the smoke of burning leaves was inhaled for the relief of headaches (Asprey and Thornton 1954a).

***Dianella ensifolia* (L.) DC. (Phormiaceae). common dianella.**

The leaves were harvested and then burned as incense in Indonesia by the Torajanese people (Widjaja 1988). In Vietnam, Cambodia, and Laos, the rhizomes were said to have a pleasant aroma when burned and were therefore used as incense (van Duong 1993).

***Dianella nemorosa* Lam. (Phormiaceae). Dianella.**

Native Hawaiians burned the roots as a fumigant for unspecified purposes (Uphof 1968; Usher 1974).

***Dichrostachys cinerea* (L.) Wight & Arn. (Fabaceae). aroma.**

Known as *umzilazembe* in Swaziland, the roots and leaves of this species were ground into a powder and then burned on a hot plate so that the smoke could be inhaled for the relief of coughs and colds (Amusan et al. 2002). It was used for similar purposes in Tanzania, where it is called *kikuratembe* (Hedberg et al. 1983), and in Somalia, where it is known as *dhiigtaar* (Samuelsson et al. 1992).

***Dicoma membranacea* S. Moore (Asteraceae). dicoma.**

Lactating mothers of the Ovambo, Namibia's largest group, burned this plant on glowing embers and inhaled the smoke to boost milk production (von Koenen 2001).

***Dictyota dichotoma* (Huds.) Lamour. (Dictyotaceae). doubling weed.**

When the leaves of this seaweed were burned, they appeared to repel or kill mosquitoes (*Culex quinquefasciatus*) according to the people of the state of Tamil Nadu, India (Thangam and Kathiresan 1992).

***Didymocarpus albicalyx* C. B. Clarke. (Gesneriaceae). kum kum dhup.**

Dried leaves were burned in Nepal for their fragrant smoke (Manandhar 2002).

***Didymocarpus cinereus* D. Don. (Gesneriaceae). Didymocarpus.**

Powdered root and rhizomes were burned for incense purposes in Nepal (Manandhar 2002).

***Dioclea reflexa* Hook. f. (Fabaceae). sea purse.**

In the Democratic Republic of Congo, the seeds of this species were burned in a calabash from which children suffering from respiratory diseases inhaled its smoke (Disengomoka et al. 1983).

***Dioscorea dumetorum* (Kunth) Pax (Dioscoreaceae). bitter yam.**

This species was burned in the Democratic Republic of Congo to treat a variety of respiratory diseases in children. The leaves were burned in a calabash to produce the smoke (Disengomoka et al. 1983).

***Diospyros argentea* Griff. (Ebenaceae). silver diospyros.**

Fumigants made with the leaves of this species have been used to repel mosquitoes (Jacobson 1975). The country of use was not specified

***Diospyros melanoxylon* Roxb. (Ebenaceae). East Indian ebony.**

In India's Orissa State, where this species is known as *kendhu,* the leaves were smoked for pleasure (Sarkar et al. 2000). The dried leaves of this species, also known as tendu leaves, were used to wrap tobacco (*Nicotiana tabacum*) (Seth 2003). The leaves are of enormous socioeconomic importance to India and may be of concern to conservation scientists (Boaz and Boaz 2003).

***Diospyros undabunda* Hiern ex Greves (Ebenaceae). Diospyros.**

In the Democratic Republic of Congo, the seeds of this species were burned in a calabash so that the smoke could be inhaled by children with respiratory diseases (Disengomoka et al. 1983).

***Dipteryx odorata* Willd. (Fabaceae). tonka bean.**

This species was used in the Amazon as a general fumigant (Duke and Vasquez 1994). Elsewhere, fermented tonka seeds were used to flavor cigarettes (Lewis and Elvin-Lewis 2003). The seeds are a source of coumarin.

***Dipteryx panamensis* (Pitt.) Record & Mell. (Fabaceae). mountain almond.**

In Isthmian America, the seeds of the tonka bean were used to flavor tobacco (*Nicotiana* spp.) (Duke 1986).

***Dobera glabra* Juss. ex Pior. (Salvadoraceae). karsatta.**

The leaves were often burned for smoke that the Pokot of northern Kenya used when they went into battle, when they needed protection from wild animals, and during certain ceremonies. Young girls inhaled the smoke after being circumcised in the punyon ceremony (Timberlake 1987). The Pokot called this species *korosion*.

***Dodonaea viscosa* Jacq. (Sapindaceae). Florida hopbush.**

In Australia's Northern Territory, the leaves and branches were burned because the smoke was said to be useful for the care of newborn babies (Barr 1993). Similarly, in Oaxaca, Mexico, smoke from burning leaves was inhaled for postpartum recovery, menorrhagia, menstrual hemorrhage, infertility, and miscarriage prevention (Browner 1985). The dried leaves were burned in a water pipe by the people of the Turbat area of southern Pakistan, who inhaled the smoke produced in the pipe to relieve sore throats caused by excessive tobacco (*Nicotiana* spp.) smoke (Goodman and Ghafoor 1992).

***Dodonaea viscosa* Jacq. ssp. *mucronata* J. G. West (Sapindaceae). hopbush.**

Native Australians burned the branches of hopbush and inhaled the smoke for internal pains (Latz 1995).

***Dorema ammoniacum* D. Don. (Apiaceae). ammoniac.**

In Iran, smoke from the gum resin of this species was directed over the skin to treat general dermatological disorders (Mohagheghzadeh et al. 2006).

***Dorstenia contrayerba* L (Moraceae). contrayerba.**

Duke (1968) reported that the Bayano Cuna of Panama used the roots to flavor tobacco (*Nicotiana* spp.). Contrayerba was also used for the same purpose by various other groups of Isthmian America (Duke 1986).

***Dorstenia* sp. cf. *barniniana* Schweinf. (Moraceae). Dorstenia.**

In Ethiopia, Borana women used the smoke from burning tubers to perfume their hair, their clothes, and their animal hides (Heine and Brenzinger 1988).

***Dracunculus vulgaris* Schott (Araceae). dragon arum.**

The dragon arum was burned to generate smoke that repelled blowflies and other livestock pests in unspecified parts of the world (McIndoo 1945).

***Drimys winteri* Forst. (Winteraceae). winter's bark.**

In south-central Chile, the Mapuche burned the plant as a fumigant to treat boils and ulcers (Houghton and Manby 1985).

***Drymaria cordata* (L.) Roem & Schult. (Caryophyllaceae). whitesnow.**

The whole plant was burned in unspecified parts of Africa to produce smoke for treating headaches (Watt and Breyer-Brandwijk 1962).

***Duboisia hopwoodii* (F. Muell.) F. Muell. (Solanaceae). pituri.**

Native Australians prized this species for its stimulatory and narcotic effects (Johnston and Cleland 1933; Cleland and Johnston 1933). The leaves were dried and then either chewed with ash to help liberate the active alkaloids, or they were smoked like tobacco. The latter required that the leaves be damp, mixed with the potash of other plants, and then rolled up into a cigar (Maiden 1889b).

***Dyerophytum indicum* Kuntze (Plumbaginaceae). mellāh.**

In Oman's southern region of Dhofar, dried stems were sliced into thin pieces and then smoked with tobacco (*Nicotiana* sp.) to relieve chest complaints and breathing difficulties (Miller and Morris 1988). *Mellāh* is the Dhofari Arabic name for the species.

***Dyschoriste radicans* Nees (Acanthaceae). Busonga songa.**

Leaf powder was smoked by people of Bulamogi County, Uganda, to keep spirits at bay (Tabuti et al. 2003). *Busonga songa* is the Bulamogi name for this plant.

***Ecballium elaterium* (L.) A. Rich. (Cucurbitaceae). squirting cucumber.**

This was one of several plants used in a Moroccan polyherbal recipe burned to produce a fumigant that induced abortions in pregnant women (Merzouki et al. 2000). Refer to *Atractylis gummifera* L. for a complete list of all the species used.

***Ecbolium revolutum* C. B. Clarke (Acanthaceae). Ecbolium.**

In the Marsabit District of Kenya, the Gabbra burned this species to fumigate their gourds because of the pleasant smelling smoke it produced (Heine and Brenzinger 1988).

***Echinacea angustifolia* DC. (Asteraceae). blacksamson echinacea.**

Many *Echinacea* species are known for their medicinal uses in North America. The western Indians burned parts of this plant, also known as the coneflower, to produce smoke that was inhaled for treating headaches (Gilmore 1919). This included the Omaha (Gilmore 1919). The Ponca and Hocak used the smoke of this plant to treat distemper in horses (Gilmore 1919).

***Echinacea pallida* (Nutt.) Nutt. (Asteraceae). pale purple coneflower.**

The Sioux of North America used smoke from the plant to treat distemper in horses (Hart 1996). Elsewhere, Native Americans smoked it as a treatment for headaches (Libster 2002).

***Echinacea purpurea* (L.) Moench. (Asteraceae). eastern purple coneflower.**

Native Americans smoked parts of this plant for the relief of headaches (Libster 2002).

***Elaeis guineensis* Jacq. (Arecaceae). African oil palm.**

In the rural villages of the Oio region of Guinea-Bissau, West Africa, people burned the infructescenses of this species to generate smoke that drove mosquitoes away (Pålsson and Jaenson 1999b).

***Elettaria cardamomum* Maton (Zingiberaceae). cardamon.**

According to the Ayurveda of India, parts of this plant were macerated, smeared with ghee, and then rolled into cigarettes that were smoked to relieve asthma (Mishra 2003).

***Eleusine indica* (L.) Gaertn. (Poaceae). Indian goosegrass.**

The Pinatubo of the Philippines burned whole plants to prevent a relapse of any illness (Fox 1953).

***Elsholtzia blanda* Benth. (Lamiaceae). bantulsi.**

In the Manang District of Nepal, the leaves were often used as a substitute for tobacco (Pohle 1990).

***Elsholtzia eriostachya* Benth. (Lamiaceae). dwarf mint bush.**

The smoke of burning dried and crushed plants was used to revive a fainted or unconscious person in the Manang District of Nepal (Pohle 1990).

***Elsholtzia fruticosa* Rehder (Lamiaceae). ji gu chai.**

Manandhar (2002) reported that this species, when powdered, was burned as incense in Nepal.

***Encelia farinosa* A. Gray ex Torr. (Asteraceae). brittlebush.**

The resin was harvested in North America by an unspecified group of people, who burned it as incense (Uphof 1968).

***Endostemon tereticaulis* (Poir.) M. Ashby. (Lamiaceae). Endostemon.**

The Pokot of northern Kenya burned the leaves for its aromatic smoke (Timberlake 1987).

***Englerophytum magalismontanum* (Sonder) T. D. Penn. (Sapotaceae). Transvaal milkplum.**

The Rozi, who were scattered throughout Africa, burned the roots and used the smoke to treat rheumatism (Hutchings et al. 1996).

***Entada abyssinica* Steud. (Fabaceae). Umusange.**

The branches were burned for their smoke in Burundi, where it was inhaled for its analgesic properties (Mohagheghzadeh et al. 2006).

***Entada leptostachya* Harms. (Fabaceae). Entada.**

Borana women in southern Oromia, Ethiopia, used this species to produce scented smoke that they used to perfume and cleanse themselves (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms. The Gabbra of Kenya burned the root and bark as incense (Heine and Brenzinger 1988).

***Ephedra nevadensis* S. Wats. (Ephedraceae). Nevada joint fir.**

Parts of this plant were smoked to relieve headaches (Heffern 1974). There were no details about the country of use.

***Ephedra trifurca* Torr. (Ephedraceae). longleaf joint fir.**

A wood smudge was prepared by the Cocopa of northwestern Mexico to treat venereal diseases (Elmore 1944). The wood was mixed with charcoal, buffalo hair, wood rat hair, and bat hair.

***Epilobium angustifolium* L. (Onagraceae). fireweed.**

The Upper Tanana of North America used smoke from burning shoots as a mosquito repellant and to smoke their fish (Kari 1985).

***Epipremnum giganteum* Schott. (Araceae). Rengot.**

Smoke from burning roots was inhaled twice a week to treat nose ulcers by people of the Machang District of Malaysia's Kelantan State (Ong and Nordiana 1999).

***Eremophila latrobei* F. Muell. (Myoporaceae). native fuchsia.**

Native Australians forced their babies to inhale the smoke of smoldering leaves to enhance their chances of survival (Meggitt 1962; Latz 1995).

***Eremophila longifolia* F. Muell. (Myoporaceae). berrigan bush.**

The smoke from the leaves of this species was used to strengthen newborns and to stem the flow of postpartum bleeding (Cleland and Johnston 1933, 1937; Barr 1993; Latz 1995).

Epilobium angustifolium

***Eremophila mitchellii* Benth. (Myoporaceae). false sandalwood.**

Native Australians inhaled the smoke of burning twigs for general ailments (Low 1990).

***Eremophila neglecta* J. Black (Myoporaceae). tar bush.**

According to Native Australians, smoke from the leaves was used for unspecified medicinal properties (Latz 1995).

***Eremophila sturtii* R. Br. (Myoporaceae). turpentine.**

The Pitjantjatjara of Australia inhaled smoke from smoldering branches to relieve backache (Latz 1995). The Arrernte burned green branches to produce fumes that were believed to dispel clouds (Latz 1995). In the Northern Territory, the smoke was used as a fumigant for sore eyes (Barr 1993).

***Eremostachys loasifolia* Benth. (Lamiaceae). dannân shân.**

Villagers living between the Khuzdar and Nal areas of southern Pakistan smoldered the seeds of this species over hot coals and inhaled the smoke to remove worms that had burrowed into their gums (Goodman and Ghafoor 1992).

***Eriodictyon californicum* Greene (Hydrophyllaceae). California yerba santa.**

The Costanoan of California smoked the leaves for relief from asthma attacks (Bocek 1984). The Miwok, also of California, smoked the leaves for colds (Barrett and Gifford 1933).

***Erigeron canadensis* L. (Asteraceae). horseweed.**

Native Americans smoked the flowers and leaves for pleasure (Kavasch 1979). According to Smith (1932), the Pillager Ojibwa inhaled the smoke of burning flowers to relieve head colds. They also used it in their kinnikinnick smoking mixtures. According to Smith (1932), the disk florets of this species were smoked as hunting charms. Other Native Americans sprinkled the tops of leaves on hot coals and inhaled the smoke in their sweat lodges (Krochmal and Krochmal 1973).

Erigeron canadensis

***Erigeron philadelphicus* L. (Asteraceae). Philadelphia fleabane.**

Smoke from burning the flowers was used by the Ojibwa of North America to relieve head colds (Smith 1932). Other tribes burned com-

plete plants to relieve head colds (Speck 1941). The Ojibwa also smoked the disk florets as part of their kinnikinnick mixture and to attract buck deer (Smith 1932).

***Eriogonum divaricatum* Hook. (Polygonaceae). divergent buckwheat.**

The Kayenta Navajo of North America smoked the plant to treat snakebite (Wyman and Harris 1951).

***Eriogonum inflatum* Torr. (Polygonaceae). desert trumpet.**

The Yavapai of Arizona smoked the dried leaves with their tobacco (*Nicotiana* spp.) (Gifford 1936).

***Ervatamia coronaria* (Jacq.) Stapf (Apocynaceae). grape jasmine.**

The wood of this species was highly prized in both East India and Malaysia for burning as incense (Uphof 1968).

***Eryngium foetidum* L. (Apiaceae). cilantro.**

The Chami of the Amazon braised the dried fruits of cilantro and then burned them to produce smoke that their children inhaled to treat diarrhea (Duke and Vasquez 1994).

***Eryngium planum* L. (Apiaceae). blue eryngo.**

Aerial parts of this species were burned at night in Hungary so that children who were frightened or crying could inhale the fumes and be calmed down (Péntek and Szabó 1985).

***Erysimum repandum* L. (Brassicaceae). spreading wallflower.**

In Iran, smoke from burning fruits was considered useful for treating eye ailments (Hooper and Field 1937).

***Erythrina abyssinica* Lam. (Fabaceae). Abyssinian erythrina.**

In Bulamogi County, Uganda, where this plant is known as *mpirigiti,* the roots were burned and smoked to keep spirits at bay (Tabuti et al. 2003).

***Erythrina subumbrans* Merr. (Fabaceae). Erythrina.**

In the Philippines, the green limbs of this species were burned in house fires because the smoke reportedly kept insects away (von Reis and Lipp 1982).

***Erythrophleum chlorostachys* Baill. (Fabaceae). Cooktown ironwood.**

The Yolngu of Arnhem Land, Australia, burned the outer bark of the Cooktown ironwood to produce smoke that was considered useful for preventing future pregnancies (Scarlett et al. 1982). The smoke from the wood and leaves was also inhaled to treat constipation. In the Northern Territory of Australia, smoke from burning root bark was inhaled to end lactation (Barr 1993). Further to the north, in Groote Eylandt, the Native Australians passed their babies through the smoke of burning leaves to drive evil spirits away (Levitt 1981). The smoke from burning roots is considered toxic and should be avoided. On Groote Eylandt, this species is called *mardarra*.

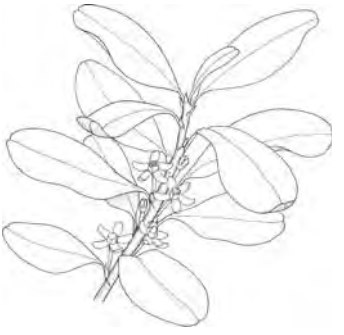
***Erythrophleum suaveolens* (Gill. and Perr.) Brenan. (Fabaceae). red water tree.**

In West Africa, smoke from burning bark was inhaled to relieve internal pains (Dalziel 1948; Irvine 1961).

***Erythroxylum coca* Lam. (Erythroxylaceae). coca.**

This is a New World plant that was chewed for centuries by the aboriginals of the Andes of South America (Castoldi 2004). It helped these people endure long hours of hunger and work. Today, it is snorted and smoked because it induces euphoria and makes one feel more confident. The active constituent, an alkaloid called cocaine, is usually prepared as a hydrochloride salt or as free-base cocaine (crack), which is smoked. Crack cocaine is made by removing the hydrochloride salt with

either ammonia or baking soda (sodium bicarbonate). The resultant substance is unstable at temperatures above 98°C and rapidly melts, allowing it to be smoked. The name crack may have been derived from the sound that it makes when it is burned (Castoldi 2004). When cocaine is smoked, the alkaloid is rapidly absorbed into the bloodstream, inducing an almost immediate effect. The introduction of crack cocaine during the 1980s, and its subsequent popularization by celebrities, has opened the door for a whole new class of cocaine users, many of them in marginal ethnic groups in Western countries. The coca plant was used by the rural women of southern Bolivia, who burned its leaves along with other unspecified plants, llama fat, colored paper, yarn, and other items to produce smoke that was offered to their gods. This was said to help them recover from various illnesses (Sikkink 2000).



Erythroxylum coca

***Ethulia conyzoides* L. f. (Asteraceae). abu elafein.**

This species was burned and used as a fumigant for unspecified purposes in parts of East Africa (Heine and Legére 1995).

***Eucalyptus camaldulensis* Dehnh. (Myrtaceae). red gum.**

In Australia's Northern Territory, young leaves were gathered and smoked for general sickness, colds, flus, and fevers (Barr 1993).

***Eucalyptus cinerea* F. Muell ex Benth. (Myrtaceae). stringybark.**

In Australia, the leaves of stringybark were added to smoking tobacco (*Nicotiana* sp.) to enhance its flavor (Cribb and Cribb 1981).

***Eucalyptus citriodora* Hook (Myrtaceae). lemon-scented gum.**

The leaves of this species have been added to smoking tobacco (*Nicotiana* sp.) in Australia to enhance its flavor (Cribb and Cribb 1981).

***Eucalyptus dives* Schauer (Myrtaceae). broadleaf peppermint.**

Australia's indigenous people inhaled the smoke of burning leaves to treat a variety of illnesses (Webb 1969). It was considered useful as a fumigant to reduce fever (Webb 1969). The leaves were also added to smoking tobacco (*Nicotiana* spp.) to enhance its flavor (Cribb and Cribb 1981).

***Eucalyptus globulus* Labill. (Myrtaceae). Tasmanian blue gum.**

Dried leaves were smoked for the treatment of asthma and other respiratory problems in North Africa (Ayensu 1979) and in parts of Southeast Asia (van Duong 1993). Villagers in the Santhal area of West Bengal, India, used the smoke from burning leaves to repel mosquitoes (Banerjee 2000).

Eucalyptus globulus

***Eucalyptus papuana* F. Muell. (Myrtaceae). ghost gum.**

The Bardi of Australia burned the bark of the ghost gum, which they called *yinubarringinja,* and then mixed the ash with other unspecified substances and smoked the mixture for pleasure (Levitt 1981).

***Eucalyptus* spp. (Myrtaceae). gum trees.**

The smoking of gum tree leaves for the relief of asthma and bronchitis was prescribed in the latter part of nineteenth-century Australia by colonial doctors, but it did not endure long as a treatment for these respiratory conditions (Cribb and Cribb 1981). In the rural villages of the Oio region of Guinea-Bissau, West Africa, people burned the leaves of an unidentified *Eucalyptus* species to generate smoke that drove mosquitoes away (Pålsson and Jaenson 1999b). These researchers reported that the smoke was significantly more effective than the negative controls that were used in their comparative study.

***Eucarya spicata* (R. Br.) Sprague & Summerh. (Santalaceae). Eucarya.**

Parts of this plant were burned for incense purposes in an unspecified country (Uphof 1968).

***Euclea natalensis* DC. (Ebenaceae). Natal guarri.**

In Venda, South Africa, the smoke of burning roots was inhaled to relieve headaches (Arnold and Gulumian 1984).

***Euclea schimperi* (DC.) Dandy (Ebenaceae). bush guarri.**

The wood, when burned, produces a thick, black smoke that was considered ideal for repelling insects and other pests in Oman's southern region of Dhofar (Miller and Morris 1988). The Dhofari Arabic name for the plant is *kilit*.

***Eugenia aromatica* Baill. (Mytaceae). clove tree.**

Ground cloves were mixed with tobacco (*Nicotiana* sp.) to produce the famous Indonesian cigarettes *kreteks* (Hanusz 2003). These are still produced to this day, with more than 500 manufacturers of the cigarettes.

***Eulalia aurea* Kunth (Poaceae). silky browntop.**

The indigenous people of the Australia's Northern Territory burned this plant with parts of termite mounds to encourage lactation in mothers and to promote health in their new babies (Barr 1993).

***Eupatorium maculatum* L. (Asteraceae). Joe-pye weed.**

The leaves were used by the Hocak (Winnebago) of North America for the preparation of smoke smudges that were used to treat a variety of illnesses (Kindscher and Hurlburt 1998).

***Eupatorium urticaefolium* Reichard (Asteraceae). white snakeroot.**

The Chickasaw of North America prepared smoke smudges to revive unconscious people (Smith 1928). Moerman (1998) suggests that the actual species used may have been *Ageratina altissima* (L.) King & H. E. Robins var. *roanensis* (Small) Clewell & Woot.

***Euphorbia cuneata* Vahl. ssp. *spinescens* (Pax) S. Carter. (Euphorbiaceae). ormamen.**

In southern Oromia, Ethiopia, the smoke generated in saunalike chambers was used to perfume and cleanse the bodies and clothes of women pastoralists (Gemedo-Dalle et al. 2005).

***Euphorbia hirta* L. (Euphorbiaceae). asthma plant.**

Parts of this plant were smoked in a pipe by some Native Australian tribes to relieve asthma attacks (Maiden 1889a; Cribb and Cribb 1981). It was also used for that purpose in Nepal (Manandhar 2002). In the Cordillera region of northern Luzon in the Philippines, the leaves were mixed in equal parts with the flowers of *Brugmansia suaveolens* (Willd.) Brecht & C. Presl and smoked to relieve asthma (Jayaweera 1980; Co 1989). The Philippine name for the species was *gatus-gatus*.

***Euphorbia ingens* E. Mey. (Euphorbiaceae). candelabra tree.**

In Zimbabwe, the latex of this species was burned to produce smoke that was inhaled for the treatment of asthma and bronchitis (Gelfand et al. 1985).

Euphorbia ingens

***Euphrasia himalayica* Wettst. (Scrophuliaraceae). Euphrasia.**

The whole plant was burned as incense in the Manang District of Nepal (Pohle 1990).

***Evodia amboinensis* Merr. (Rutaceae). Evodia.**

The dried bark of *E. amboinensis* was burned for incense purposes in parts of Indonesia (Uphof 1968).

***Evolvulus alsinoides* L. (Convulvulaceae). slender dwarf morning glory.**

The leaves of this species were smoked throughout the Indian subcontinent to treat bronchitis, asthma, and other respiratory ailments. The main centers of use were India (Uphof 1968; Usher 1974), including the Garasia tribe of Rajasthan State (Singh and Pandey 1998) and people of the Tirunelveli District in Tamil Nadu State (Thomas and De Britto 2000), Nepal (Manandhar 2002), and along the India–Nepal border (Ranjan 2000). It was also smoked in Sri Lanka (Jayaweera 1980).

***Excoecaria agallocha* L. (Euphorbiaceae). milky mangrove.**

Native Fijians burned the wood to inhale its smoke for curing ulcers (Cribb and Cribb 1981) and for treating leprosy (Jayaweera 1980). This was also common in India, where the smoke from burning the wood was used (Bandaranayake 1998). The wood was burned in unspecified areas of Southeast Asia as incense (Uphof 1968; Usher 1974). The smoke has also been shown to repel and kill mosquitoes (Thangam and Kathierson 1992; Thangam and Kathierson 1993).

***Exocarpus latifolius* R. Br. (Santalaceae). broad-leafed native cherry.**

In the Northern Territory of Australia, smoke from burning the leafy branches was believed to make babies thrive (Barr 1993).

***Fabiana bryoides* Phil. (Solanaceae). Fabiana.**

The pre-Altiplanic people of Chile burned the stems of this species as incense (Aldunate et al. 1983).

***Fagara chalybea* Engl. (Rutaceae). ngwevna.**

In parts of Botswana, the roots were burned for smoke that was reportedly used as a remedy for snakebite (Mohagheghzadeh et al. 2006). *Ngwevna* is its Botswanan name.

***Fagus grandiflora* Ehrh. (Fagaceae). American beech.**

German soldiers smoked the leaves of this beech species as a substitute for tobacco (*Nicotiana* spp.) (Grieve 1931).

***Faramea guianensis* (Aubl.) Bremek. (Rubiaceae). Ipeca.**

In parts of French Guiana, the entire plant was burned to fumigate wounds while they were being dressed (Defilipps et al. 2004).

***Fatsia horrida* Benth & Hook. f. (Araliaceae). devil's club.**

The Crow of North America mixed the roots with tobacco (*Nicotiana* spp.) and smoked them to relieve headaches (Blankinship 1905). Moerman (1998) suggests that the species actually used may have been *Oplopanax horridus* Miq.

***Ferula assa-foetida* L. (Apiaceae). haltîda.**

This species found use in Yemen, where the resin was burned to produce smoke that was passed over a female's vagina after she gave birth (Ghazanfar 1994). The smoke was believed to help the vagina contract.

***Ferula communis* L. (Apiaceae). giant fennel.**

In the Italian city of Bivona in Sicily's province of Agrigento, unspecified parts of giant fennel were smoked as a medication to bring up mucus (expectorant) (Catanzaro 1970).

***Ferula foetida* Regel (Apiaceae). devil's dung.**

The smoke of this species was used as a remedy for colic in children of the urban African American communities of Detroit, Michigan (Smitherman et al. 2005). This species is sometimes known as devil's dung because of its foul smell and taste.

***Ferula jaeschkeana* Vatke (Apiaceae). the caper bush.**

Smoke from burning gum resins was inhaled in Tibet to relieve asthma (Tsarong 1986).

***Ferula sumbul* Hook f. (Apiaceae). muskroot.**

Usher (1974) reported that this plant was burned as incense in central Asia. The plant parts used were not specified.

***Ficus carica* L. (Moraceae). edible fig.**

The leaves of this fig were chopped and then smoked for recreational purposes in Spain's Almería Province (Martínez-Lirola et al. 1996). Elsewhere, the leaves were smoked in a pipe for the relief of sinus or bad chest pains (Crellin 1990).

***Flacourtia indica* (Burm. f.). Merr. (Flacourtiaceae). governor's plum.**

This species was used in parts of East Africa to treat the houses of people who were affected by bad or evil charms (Heine and Legére 1995), which were removed during special ceremonies of which fumigations with this species were an integral part. The Swahili name for this plant is *mao*.

***Flueggea virosa* (Willd.) Voigt (Euphorbiaceae). common bushweed.**

The roots of common bushweed were smoked to keep spirits at bay in Bulamogi County, Uganda (Tabuti et al. 2003).

***Foeniculum officinalis* All. (Apiaceae). fennel.**

The Hopi of North America used fennel as a substitute for tobacco (*Nicotiana* spp.) (Whiting 1939). Moerman (1998) suggests that the species actually used was probably *Foeniculum vulgare* Mill. Ross (2002) reported that the seeds can be sprinkled on smoke mixes, giving them a sweet aroma.

***Foeniculum vulgare* Mill. (Apiaceae). fennel.**

See *Foeniculum officinalis* All.

***Frankenia palmeri* S. Wats. (Frankeniaceae). saladito.**

This plant was one of the first plants created according to the Seri of Mexico (Felger and Moser 1985). They used it during a number of their smoking ceremonies.

***Fraxinus excelsior* L. (Oleaceae). European ash.**

In Ireland, the Antrim inhaled the smoke of smoldering twigs as a form of worm treatment (Vickery 1995).

***Fraxinus nigra* Marsh. (Oleaceae). black ash.**

The Parry Island Ojibwa of North America used the berrylike tips of this ash as a tobacco substitute when tobacco (*Nicotiana* spp.) was scarce (Jenness 1935).

***Fuchsia excorticata* L. f. (Onagraceae). tree fuchsia.**

Early settlers in New Zealand smoked strips of bark from this species as a tobacco (*Nicotiana* spp.) substitute (Stark 1979).

***Fumaria* sp. (Fumariaceae). fumitory.**

The Cavan of Ireland believed that smoke from an unspecified species of the *Fumaria* genus was an excellent cure for stomach troubles (Spence 1914).

***Gardenia latifolia* Schlecht. ex Hook. f. (Rubiaceae). Ceylon boxwood.**

In parts of Sri Lanka, the resin of the Ceylon boxwood was burned to produce smoke that was useful for fumigating and treating sores (Jayaweera 1982b).

***Gardenia spatulifolia* Stapf & Hutch. (Rubiaceae). common gardenia.**

The Kwanyama Ovambo of Ovamboland, Namibia, burned the wood of this species and inhaled the smoke for the relief of head colds (Rodin 1974; Rodin 1985).

***Gardenia volkensii* K. Schum. ssp. *spatulifolia* (Stapf & Hutch.) Verdc. (Rubiaceae). Gardenia.**

In Namibia, the smoke from burning wood was used to treat head colds (Rodin 1985).

***Gaura parviflora* Dougl. ex Lehm. (Onagraceae). smallflower gaura.**

The Kayenta of North America used this plant as a fumigant for unspecified purposes (Wyman and Harris 1951).

***Gaylussacia baccata* K. Koch. (Ericaceae). black huckleberry.**

The Iroquois of North America considered this species an important food and also valued, to some degree, the leaves, which were smoked for pleasure (Bye 1970).

***Geigera ornativa* O. Hoffm. ssp. *ornativa* (Asteraceae). speikraut.**

The Himba of Namibia trampled the leaves before burning them on red-hot coals and then using the smoke as a fumigant to treat swollen legs and feet (von Koenen 2001).

***Geijera parviflora* Lindl. (Rutaceae). Australian willow.**

Native Australians baked and powdered the leaves of the Australian willow and then smoked them with other narcotic plants to induce drowsiness during certain ceremonies (Webb 1969).

***Gerbera piloselloides* Cass. (Asteraceae). yellow gerbera.**

This plant was prized by the Sotho of Africa for its use as a disinfecting fumigant for huts where people with colds lived (Watt and Breyer-Brandwijk 1962).

***Geum triflorum* Pursh. (Rosaceae). old man's whiskers.**

The Blackfoot of North America added the roots of this species to tobacco (*Nicotiana* spp.) and smoked the mixture to clear the head (Hellson 1974).

***Gilia leptomeria* A. Gray. (Polemoniaceae). sand gilia.**

The Kayenta Navajo of North America smoked this plant as a tonic (Wyman and Harris 1951).

***Gilia multiflora* Nutt. (Polemoniaceae). many-flower ipomopsis.**

The Zuñi of North America smoked this plant in cigarettes rolled in corn husks to relieve strangulation (Stevenson 1909). The Zuñi name for the plant is *ha'sililiwe li'anna,* meaning "blue leaves in delicate motion." This species has since been reclassified as *Ipomopsis multiflora* (Nutt.) V. Grant.

***Gladiolus dalenii* van Geel. (Iridaceae). yellow gladiolus.**

The Sotho of Africa inhaled smoke from burning corms as a remedy for colds (Watt and Breyer-Brandwijk 1962).

***Gloriosa superba* L. (Colchicaceae). flame lily.**

When cattle belonging to the Borana of Ethiopia and Gabbra of Kenya were bitten by snakes, they were treated with fumigations of this species (Heine and Brenzinger 1988).

***Glyceria aquatica* (L.) Wahlb. (Poaceae). reed manna-grass.**

The Crow and Montana of North America burned this plant for incense purposes (Barrett and Gifford 1933). Moerman (1998) suggests that the species actually used may have been *Catabrosa aquatica* P. Beauv.

***Glycyrrhiza glabra* L. (Fabaceae). licorice.**

The root has been added to some tobacco (*Nicotiana* spp.) products in Egypt to add flavor (Manniche 1989).

Glycyrrhiza glabra

***Gnaphalium japonicum* Thunb. (Asteraceae). Japanese cudweed.**

When children in Lesotho, Africa, had high fever, their huts were fumigated and cleansed with the smoke produced during the burning of this plant (Perry 1980).

***Gnaphalium margaritaceum* L. (Asteraceae). cudweed.**

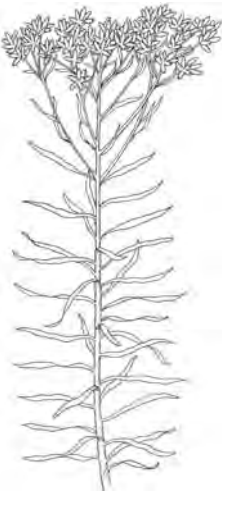
This species was smoked as a tobacco (*Nicotiana* spp.) substitute in North America (Rafinesque 1828).

***Gnaphalium polycephalum* Michx. (Asteraceae). Indian posy.**

Native Americans burned the leaves of Indian posy, inhaling its smoke to relieve headaches (Kavasch 1979). It was also smoked for recreational purposes. This species was used separately or with the galls obtained from a beaver's body to make a smoke smudge meant to revive fainted or unconscious people (Smith 1923). The smoke was blown into the person's nostrils. The smudge was also believed to drive away ghosts. The Meskwaki of North America also used the smudge to revive unconscious people (Smith 1928).

***Gnaphalium obtusifolium* L. (Asteraceae). sweet everlasting.**

The Cherokee (Hamel and Chiltoskey 1975) and Rappahannock (Speck et al. 1942) of North America smoked unspecified parts of this plant for the relief of asthma.



Gnaphalium obtusifolium

***Gnetum nodiflorum* Brongn. (Gnetaceae). gnetum.**

This species was often burned as incense in Venezuela (von Reis and Lipp 1982).

***Gnetum* sp. (Gnetaceae). joint firs.**

Hunters in northern Thailand's Akha area threw small pieces of wood broken off from an unspecified species of joint fir into their campfires because it was believed to keep evil spirits away (Anderson 1993).

***Gnidia burchellii* Gilg. (Thymelaeaceae). Burchell's gnidia.**

In Africa, the Sotho burned whole plants and inhaled the smoke to prevent nightmares and fevers (Watt and Breyer-Brandwijk 1962).

***Gnidia capitata* L. f. (Thymelaeaceae). kerrieblom.**

In South Africa, the leaves were ground and then smoked to treat stomachache, earache, and toothache (Gelfand et al. 1985; Hutchings and van Staden 1994). *Kerrieblom* is its Africaans name.

***Gnidia gymnostachya* Gilg. (Thymelaeaceae). Gnidia.**

Like *G. capitata* L. f., the leaves were ground and smoked to treat stomachache, earache, and toothache in South Africa (Gelfand et al. 1985; Hutchings and van Staden 1994).

***Gnidia* sp. (Thymelaeaceae). Gnidia.**

In Africa, the roots of an unspecified species of *Gnidia* were burned to produce smoke that was inhaled for the relief of coughs, general pain, and headaches (Watt and Breyer-Brandwijk 1933; Watt and Breyer-Brandwijk 1962).

***Goniothalamus macrophyllus* Hook. f. & Thoms. (Annonaceae). selayak hitam.**

The twigs were burned in parts of Asia to produce smoke that was reported to repel mosquitoes (Salek 1989; Lewis and Elvin-Lewis 2003). *Selayak hitam* is the Malaysian name for this plant.

***Goniothalamus malayanus* Hook. f. & Thoms. (Annonaceae). Goniothalamus.**

The smoke from burning leaves was considered an effective mosquito repellent in Malaysia (Salek 1989).

***Gonystylus bancanus* (Miq.) Kurz. (Thymelaeaceae). aloe wood.**

This species was burned both in Java, Indonesia, and in parts of Malaysia for incense purposes. The Javanese burned the wood (Sangat-Roemantyo 1990), whereas the Malaysians burned the oil derived from the wood (Usher 1974).

***Gonystylus macrophyllus* (Miq.) Airy Shaw (Thymelaeaceae). bidaru.**

In India, the wood was smoked for the relief of asthma (Chopra et al. 1969).

***Gonystylus miquelianus* Teijsm. & Binn. (Thymelaeaceae). ramin.**

The wood of this species was burned as incense in Malaysia, and the wood oil was burned to generate smoke that was inhaled for the relief of asthma (Uphof 1959).

***Gossypium arboreum* L. (Malvaceae). tree cotton.**

Smoke from burning seeds was used as a fumigant for unspecified purposes in both the Lesser and Greater Antilles and Mauritius (Hartwell 1970).

***Gossypium herbaceum* L. (Malvaceae). levant cotton.**

According to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), the leaves of this species, when burned with other plant and animal ingredients, produce smoke that causes blindness in one's enemies (see *Abrus precatorius* L.) (Sensarma 1998).

***Grevillea stenobotrya* F. Muell. (Proteaceae). rattlepod grevillea.**

Native Australians burned the leaves and inhaled the smoke for unspecified medicinal purposes (Latz 1995).

***Grewia bicolor* Juss. (Tiliaceae). bastard brandybush.**

The shamans of the Pokot of northern Kenya, known as the *liokin*, burned the leaves of this species to fumigate sick cattle (Timberlake 1987). The species is known locally as *sitat*.

***Grewia microcus* L. (Tiliaceae). Grewia.**

The leaves were used to make Burmese cheroots, which were smoked by people of the Andaman and Nicobar Islands, India (Dagar and Dagar 1999).

***Guaiacum* spp. (Zygophyllaceae). lignum vitae.**

The Aztec of Mexico burned the resins of various *Guaiacum* species as incense to treat colds and for their aphrodisiacal properties (Rätsch 2004).

***Guiera senegalensis* J. F. Gmel. (Combretaceae). tiger bush.**

In Dogonland, Mali, West Africa, the smoke from burning tiger bush stems and leaves was inhaled to treat the wounds caused by Satan (Inngjerdingen et al. 2004). This species is known locally as *toniburu*.

***Guilandina bonducella* L. (Fabaceae). gray nicker.**

The leaves of this species, according to the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya*, were burned with other plant and animal ingredients to produce smoke that causes blindness in one's enemies (see *Abrus precatorius* L.) (Sensarma 1998).

***Gutierrezia furfuracea* Greene (Asteraceae). broom snakeweed.**

See *Gutierrezia sarothrae* (Pursh) Britt. & Rusby.

***Gutierrezia sarothrae* (Pursh) Britt. & Rusby (Asteraceae). broom snakeweed.**

According to Foster and Hobbs (2002), smoke from this plant was burned as a fumigant to help newborn babies and their mothers. It was also used for women who were experiencing powerful contractions. Moerman (1998) suggests that it was this species that the Hopi used for killing bees and not *G. furfuracea* Greene as reported in the original texts.

***Gutierrezia* sp. (Asteraceae). snakeweed.**

The Hopi of North America burned a unknown species of snakeweed over a slow fire to generate smoke that was said to destroy and kill bees (Cook 1930).

***Gymnosporia royleana* M. Laws. (Celastraceae). jaliddar.**

In India's Udhampur District of Jammu Province, the seeds of this species were smoked to relieve toothache (Kapur and Singh 1996).

***Hagenia abyssinica* J. F. Gmel. (Rosaceae). musuzi.**

In parts of Ethiopia and Kenya, the roots and wood of this species were burned to tan and smoke cowhides. The smoke was also used to perfume clothes and other items (Heine and Brenzinger 1988).

***Hanghomia marseillei* Gagnep. and Thénint. (Apocynaceae). hanghomia.**

The roots of this species were burned as incense in the local pagodas of Laos (Uphof 1968; Usher 1974).

***Haplocoelum foliolosum* (Hiern) Bullock (Sapindaceae). northern gala plum.**

The Borana of Ethiopia and the Gabbra of Kenya used this species to fumigate and cleanse their containers (Heine and Brenzinger 1988).

***Harrisonia abyssinica* Oliv. (Simaroubaceae). pedu.**

In Ghana, the Nyamwezi "swallowed" the smoke of burning roots to treat ancylostomiasis (Watt and Breyer-Brandwicjk 1962). The smoke was said to traverse the intestine to mediate the disease's effects.

***Hedychium spicatum* Sm. (Zingiberaceae). perfume ginger.**

This plant was sold and burned as incense in the markets of Jima, Ethiopia, where it is known as *afer kocher* (Siegenthaler 1971).

***Helenium cusickii* A. Gray. (Asteraceae). cusick's sunflower.**

The Shasta of northwestern California often burned this species to fumigate their houses, especially when they were inhabited by a patient who had suffered a long, slow illness with fevers and chills (Holt 1946).

***Helenium microcephalum* DC. (Asteraceae). smallhead sneezeweed.**

The Comanche of North America inhaled the smoke of this plant to help eliminate afterbirth (Carlson and Jones 1939).

***Helianthus* spp. (Asteraceae). sunflower.**

Native North Americans smoked the leaves of several unspecified sunflower species as substitutes for tobacco (*Nicotiana* spp.) (Kavasch 1979).

***Helichrysum aureonitens* Sch. Bip. (Asteraceae). golden everlasting.**

The Zulu of South Africa burned the leaves and stems of the golden everlasting for incense purposes (Hutchings et al. 1996). Zulu diviners, called *inzagomas*, smoked the leaves and stems to induce trancelike states prior to their mantic sessions.

***Helichrysum cymosum* D. Don. (Asteraceae). baby kooigoed.**

Midwives in Transkei, South Africa, burned leaves of this species for smoke that was used to fumigate newborn babies and to chase away evil spirits (Dlisani and Bhat 1999).

***Helichrysum decorum* Krauss ex Harv. & Sond. (Asteraceae). decorative everlasting.**

African Zulu *inzagomas* (diviners) smoked unspecified parts of this plant to induce trances, during which they were able to divine cures and perform other services for members of the tribe (Hutchings et al. 1996).

***Helichrysum epapposum* Bolus ex J. M. Wood. (Asteraceae). strawflower everlasting.**

The leaves and stems of this species were burned as incense by the Zulu of South Africa (Hutchings et al. 1996).

***Helichrysum foetidum* Moench. (Asteraceae). strawflower.**

This herb was dried and then smoked for its hallucinogenic effects by the shamans of Zululand, Africa (Schultes et al. 2001).

***Helichrysum gymnocomum* DC. (Asteraceae). Helichrysum.**

Leaves and stems were burned by the Zulu of Africa to generate smoke that was used to invoke the goodwill of their ancestors (Hutchings et al. 1996).

***Helichrysum herbaceum* Sweet (Asteraceae). monkey-tail everlasting.**

In South Africa, the Zulu burned the leaves and stems to produce smoke that was believed to invoke the goodwill of their ancestors (Hutchings et al. 1996).

***Helichrysum italicum* (Roth) G. Don. (Asteraceae). curry plant.**

The smoke of burning branches, which were lit on Christmas Eve in Tuscany and elsewhere in Italy, was used as a fumigant to ward off the evil eye (Pieroni and Giusti 2002). In the upper Lucca Province of Italy, the aerial parts of this plant were burned in the preparation of fumigants for treating colds, as a bechic agent (cough suppressor), and as a good omen (Pieroni 2000).

***Helichrysum kirkii* Oliv. & Hiern. (Asteraceae). Kirk's everlasting.**

The roots of this species were used in conjunction with others to treat tuberculosis in northern and eastern Mozambique (Verzár and Petri 1987). Patients dried the plant parts and placed the mixture on glowing coals. They then covered themselves with a blanket and inhaled the smoke. The other species in the mixture were *Aspilia mossambicensis* (Oliv.), *Clematopsis scabiosifolia* Hutch., *Clerodendron discolor* Becc., and *Ozoroa schinzii* (Engl.) R. Fern. & A. Fern. It was also used in Mbeere, Kenya, where the whole plant was burned to make smoke that drove bees away as well as beehive predators (Riley and Brokensha 1988). The Kenyan name for the species is *taa*.

***Helichrysum litoreum* Guss. (Asteraceae). tabbaccazzu.**

Sun-dried inflorescences, known as *tabbaccazzu* in Italy, were smoked in that country for the relief of bronchial asthma (Ruberto et al. 2002). The smoke is considered a powerful disinfectant and has also found use for this purpose.

***Helichrysum natalitium* DC. (Asteraceae). Natal everlasting.**

The Zulu of South Africa burned the leaves and stems of this everlasting as incense (Cunningham 1988). This was said to invoke the goodwill of their ancestors.

***Helichrysum nudifolium* Less. (Asteraceae). Hottentot's tea.**

Like *H. natalitium* DC., the leaves and stems of this species were burned as incense that was used to invoke the goodwill of ancestors. The Zulu also considered the smoke from the leaves, when inhaled, useful for relieving headaches (Hutchings et al. 1996).

***Helichrysum odoratissimum* Sweet (Asteraceae). imphepho.**

Leaves and stems were burned for incense purposes by the Zulu of Africa. This was said to invoke the goodwill of ancestors. They also inhaled the smoke of burning leaves to alleviate coughs and colds (Hutchings and Johnson 1986). The Lesotho of southern Africa burned the complete plant to fumigate sickrooms (Jacot Guillarmod 1971).

***Helichrysum* spp. (Asteraceae). everlastings.**

In South Africa, the smoke of burning leaves of many *Helichrysum* species was inhaled for the relief of pain (Hutchings and van Staden 1994; Hutchings et al. 1996; Schwegler 2003).

***Helichrysum stenopterum* DC. (Asteraceae). strawflower.**

Like *H. foetidum,* this herb was dried and then smoked by the shamans of Zululand, Africa, for its hallucinogenic effects (Schultes et al. 2001).

***Helosis cayennensis* Spreng. (Balanophoraceae). Kamarassana.**

The entire plant was burned in Suriname to produce smoke that was considered useful as a snakebite remedy (Defilipps et al. 2004).

***Hemizygia bracteosa* Briq. (Lamiaceae). purple top.**

In Namibia, this plant was burned beside huts to drive away mosquitoes (von Keonen 2001).

***Heracleum lanatum* Michx. (Apiaceae). hogweed.**

The Menomini (Smith 1923), Weskwaki (Smith 1928), and Pillager Ojibwa (Smith 1932) of North America all burned this species because its smoke was thought to drive away the evil spirit Sokênau, who could steal one's hunting luck. Unspecified parts of the plant were thrown on a fire for its smoke, the odor of which permeated the air for great distances. This prevented Sokênau from approaching. The Gitskan, also of North America, mixed this plant with red elder bark and juniper boughs to prepare a smudge that kept evil witchcraft at bay (Comptom 1993). Moerman (1998) suggests that the species actually used was probably *H. maximum* Bartr.

***Heracleum maximum* Bartr. (Apiaceae). pushkie.**

Smoke from burning flower tops and roots was used by Native North American tribes to revive a fainted or unconscious person and for treating head colds, respectively (Foster and Hobbs 2002). See also *H. lanatum* Michx.

***Hernandia beninensis* Welw. ex Henriq. (Hernandiaceae). bungá.**

The people of Gabon burned the bark of this species to prepare fumigations used as enemas that were believed to cure madness (Watt 1967).

***Hertia intermedia* Kuntze. (Asteraceae). môngûlî.**

The smoke generated by burning the entire plant was used as an insect repellent in parts of the Kalat area of southern Pakistan (Goodman and Ghafoor 1992).

***Heteromeles arbutifolia* (Lindl.) M. Roem. (Rosaceae). toyon.**

The Chumash of California burned the wood of toyon to produce smoke used to flavor and preserve their fish (Timbrook 1990).

***Heteromorpha arborescens* Cham & Schltdl. (Apiaceae). parsley tree.**

The smoke of burning parsley tree plants was inhaled in South Africa to treat headaches (Hutchings et al. 1996).

***Heteromorpha trifoliata* Eckl. & Zeyh. (Apiaceae). parsnip tree.**

The Sotho of South Africa prized the smoke produced by burning this plant for curing headaches (Jacot Guillarmod 1971).

***Hierochloe odorata* (L.) Beauv. (Poaceae). sweet grass.**

The Kiowa of New Mexico burned previously buried foliage of this species to produce smoke that was considered ideal for incense purposes (Uphof 1968). The Cheyenne of North America burned the plant as incense during ceremonies for purification. They also burned the species in their homes to ward off evil (Hart 1981). The Blackfoot and Sioux, also of North America, burned the grass and used the smoke to purify sundancers. The Blackfoot smoked the leaves with tobacco (*Nicotiana* spp.) for pleasure (Hart 1996). The Flathead of North America burned the plant to repel insects (Hart 1996). The Montana tribes of North America used the smoke for spiritual protection and purification (Hart 1996). According to Foster and Hobbs (2002), other Native Americans burned the leaves to summon guardian spirits that protected members of the tribes from thunder and lightning. The smoke was also used as an insect repellent and was inhaled to treat colds.

Hierochloe odorata

***Hildebrandtia obcordata* S. Moore. (Convulvulaceae). Hildebrandtia.**

Smoke generated in saunalike chambers was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, refer to *Acacia goetzei* Harms.

***Hildebrandtia somalensis* Engl. (Convulvulaceae). Somali hildebrandtia.**

Borana women of Oromia, Ethiopia, burned this species to perfume and cleanse their bodies and clothes (Gemedo-Dalle et al. 2005). For more information on this practice, refer to *Acacia goetzei* Harms.

***Hipposelinum* sp. (Apiaceae). lovages.**

According to John Keogh's ancient *Botanalogia Universalis Hibernica of 1735,* the seeds of a species of *Hipposelinum* (unclear from text) were mixed with tobacco (*Nicotiana* spp.) and smoked in a pipe to relieve toothache (Scott 1986).

***Holarrhena antidysenterica* (L.) Wall (Apocynaceae). tellicherry bark.**

According to the Indian Yunani system of medicine, the bark of this species was considered useful as a fumigant for piles (Kaul and Atal 1983). The leaves were also burned to fumigate a mother and her child after childbirth.

***Homalanthus alpinus* Elmer (Euphorbiaceae). Alpine bleeding heart.**

The green smoke generated by burning this plant can irritate the eyes and make them weep according to local people of the Philippine islands (von Reis and Lipp 1982).

***Homalomena aromatica* Schott. (Araceae). anchiri.**

At the extreme end of the Himalayan ranges in the Mizoram State of India, the rhizomes of this species were collected, dried, and then burned to produce smoke that repelled mosquitoes (Lalramnghinglova 2003). *Anchiri* is its local name.

***Hoslundia opposita* Vahl. (Lamiaceae). orange bird lantern.**

This species was used in several villages in the Tanga District of Tanzania. The leaves were burned, after which the smoke was inhaled to drive away the devil (Hedberg et al. 1983). This required a few other ingredients. In other practices, the leaves were mixed with the leaves of *Cissus rotundifolia* Vahl., which were dried, powdered, and then smoked in a pipe to treat bad breath. The smoke was inhaled through the mouth and blown out through the nostrils.

***Houstonia wrightii* A. Gray. (Rubiaceae). pygmy bluet.**

The Ramah Navajo of North America burned this plant as a fumigant to treat deer infection (Vestal 1952).

***Hura crepitans* L. (Euphorbiaceae). sandbox tree.**

In parts of Costa Rica, the smoke generated by burning the wood of the sandbox tree was used to repel insects (Duke 1968).

***Hydnocarpus kurzii* Warb. (Flacourtiaceae). chaulmoogra.**

In India's Mizoram State, where this species is known as *khawitur,* the smoke of burning bark was used to subdue honeybees when collecting their honey (Lalramnghinglova 2003).

***Hygrophila gracillima* Burkill. (Acanthaceae). Hygrophila.**

The Kuanyama Ango women of Angola burned this grass and inhaled the smoke after childbirth (Loeb et al. 1956).

***Hymenaea courbaril* L. (Fabaceae). stinking toe.**

This was a species favored in St. Bartholomew of the West Indies. Smoke from the burning of rosin (a type of resin) was inhaled for treating headaches and rheumatism (Questel 1941). In other parts of the Caribbean, the resin, which often accumulates at the base of the tree or in the soil (fossil gum), was made into cakes and burned in churches as incense (Longwood 1971). The local name for the resin is South American *copal,* and the local trade name for the species is *courbaril.*

***Hymenaea davisii* Sandwith (Fabaceae). locust bean.**

In some parts of the Caribbean, resin from the bark of this species was harvested to burn as incense in churches (Longwood 1971).

***Hymenaea oblongifolia* Huber (Fabaceae). locust.**

The Yukuna of the Amazon harvested the resin of this species and burned it as incense (Schultes and Raffauf 1990).

***Hymenaea verrucosa* Gaertn. (Fabaceae). palo jiote tree.**

The Quiche of Guatemala used the pine resin of the palo jiote tree during some of their incense ceremonies (Tedlock 1985). There is some debate as to whether this species is in fact one of the *Bursera* species (Stross 1997).

***Hymenocardia acida* Tul. (Hymenocardiaceae). kampalaga.**

To keep spirits at bay, the people of Bulamogi County, Uganda, smoked the roots of this species (Tabuti et al. 2003).

***Hymenophyllum polyanthus* Sw. (Hymenocardiaceae). Sho-roi-sho-roi-ah-wuh-mu.**

Smoke from burning wood was inhaled in Suriname to treat mental disorders (Defilipps et al. 2004). *Sho-roi-sho-roi-ah-wuh-mu* is its Surinamese name.

***Hyoscyamus albus* L. (Solanaceae). white henbane.**

Henbane is considered by some authorities to be one of the most important hallucinogenic plants in Europe (Schultes et al. 2001). Its leaves were commonly used by oracles, and it was ritually burned for its smoke in ancient Greece. It has even been suggested that the priestesses in the Temple of Apollo, Greece's oracles of Delphi, uttered their prophecies after they had smoked the seeds of white henbane (Stefanis et al. 1975). In Cyprus, where the name for the plant is *dontochorton,* dried leaves were mixed with those of tobacco (*Nicotiana* sp.) and were smoked as a cigarette for the relief of asthma (Georgiades 1987b). In Morocco, the species was burned along with other plants for smoke that induced abortions (see *Atractylis gummifera* L.; Merzouki et al. 2000).

Hyoscyamus albus

***Hyoscyamus boveanus* Asch. ex Schweinf. (Solanaceae). Egyptian henbane.**

The Bischarin Bedouins of the Egyptian eastern desert occasionally mixed the flowers of this species with tobacco (*Nicotiana* sp.) and smoked the mixture for its intoxicating effects (Goodman and Hobbs 1988). A closely related group, the Khushmaan Bedouins, also smoked the leaves for their mind-altering effects. The Arabic name for this plant is *saykaran,* which means "to become intoxicated."

***Hyoscyamus muticus* L. (Solanaceae). henbane.**

Bedouin thieves in Egypt used the smoke of burning leaves to induce a state of narcosis in their victims (Kassas personal communication in Osborn 1968). They also smoked the leaves to help relieve asthma (Boulos 1966).

***Hyoscyamus niger* L. (Solanaceae). black henbane.**

For centuries, on the eve of St. John the Baptist's birthday, June 23, Europeans have burned henbane in their barns to protect their cattle from evil (Schleiffer 1979). The smoke from burning seeds was also said to be useful in protecting children from witches, sickness, and bad luck. A considerable effort went into producing the smoke, some of which was fanned out across fields of crops to protect them as well. The lighting of fires for St John's birthday has persisted since the fourth century, when it replaced the ancient summer solstice celebrations of pagan times. Brushwood of any type is now used to make the fires. Like *H. albus* L., this species is often listed as an ingredient in witches' brews and was smoked for its hallucinogenic properties (Schultes et al. 2001). In the southern parts of the Kashmir Himalayas, the local people smoked the leaves with tobacco (*Nicotiana* sp.) specifically for that purpose (Shah 1982). The seeds were, for the most part,

preferred to other plant parts of this species. In Hungary, where the people refer to this species as *bulondító belindek,* both the seeds and leaves were smoked to treat toothache (Oláh 1987; Rab 1991). The Shashin of the Lahoul Valley of India (northwestern Himalayas) have used the seeds for that same purpose (Sood et al. 2001). Typically, the smoke was blown into cavities through a wheat stem. The fruits of the species were smoked to treat toothache in Nepal's Manang District (Pohle 1990). The use of henbane smoke to treat toothache and other odontological conditions is an ancient practice. Its ability to remove worms from the teeth was recorded as early as 1597 in *Gerard's Herbal*, where it was reported that "the seed is used by Mountibank tooth-drawers which run about the country, to cause worms come forth of the teeth, by burning it in a chafing dish of coles, the party holding his mouth over the fume thereof" (Woodward 1994). The leaves were burned for incense purposes in Punjab, India. The inhabitants of Sardinia, Italy, smoked the leaves in cigarette form to relieve asthma attacks (Jacobs 1997). In parts of Ukraine, where this species is known as *berlena chernaya,* the leaves were used in blends of plant parts that were smoked as a remedy for asthma (Kondratyuk et al. 1967). In Turkey, the fruits and leaves were burned to generate smoke that was inhaled for respiratory disorders (Sezik et al. 1991; Yeşilada et al. 1999). Black henbane is a poisonous plant and should never be used in any way whatsoever by untrained individuals.

Hyoscyamus niger

***Hyoscyamus reticulatus* L. (Solanaceae). Egyptian henbane.**

The fruits of this species were smoked in parts of Iran as a toothache remedy (Hooper and Field 1937).

***Hyphaene coriacea* Gaertn. (Arecaceae). doum palm.**

In the southern half of the Marsabit District of northern Kenya, the Rendille burned the seeds to give a pleasant aroma in their houses (Heine and Heine 1988b).

***Hyptis pectinata* Poit. (Lamiaceae). comb bushmint.**

The resin of this species was burned for incense purposes in parts of Africa (Uphof 1968; Usher 1974).

***Hyptis spicigera* Lam. (Lamiaceae). marubio.**

Fumigations produced by burning the aerial parts of this plant have been reported to repel mosquitoes and termites in parts of West Africa and elsewhere (Dalziel 1937; Jacobson 1975) and to repel stored grain pests (McIndoo 1945).

***Hyptis* spp. (Lamiaceae). bushmints.**

Several species of *Hyptis* were traditionally burned in the Brazilian Amazon for their smoke, which was used to repel mosquitoes (Sears 1996).

***Hyptis suaveolens* (L.) Poit. (Lamiaceae). wild spikenard.**

The hilltop Totos of the Jalpaiguri District of India's West Bengal State burned the dried aromatic leaves of this plant in their cattle sheds to repel flies and mosquitoes (Mudgal et al. 1999). The Totopara name for the plant is *dompaishing*.

In West Africa, smoke from burning the aerial parts of this species was also said to repel mosquitoes (Pållsson and Jaenson 1999a). Elsewhere, fresh whole pig nut was placed on glowing charcoal to produce smoke to repel mosquitoes (Curtis 1999). The country and users were not specified. In the Tanga District of Tanzania, villagers in Mpirani and Kiomani used this species, known locally as *kifumbasi,* as part of a treatment for mental diseases (Hedburg et al. 1982). The plant was mixed with elephant dung and chicken feathers, all of which were then burned before the smoke was inhaled.

Hyptis suaveolens

***Ichnanthus panicoides* P. Beauv. (Poaceae).**
ku-pe-te-ah.

In parts of Suriname, the entire plant was burned for smoke that was inhaled as a remedy for stomachache (Defilipps et al. 2004).

***Ilex paraguariensis* A. St-Hil. (Aquifoliaceae). yerba mate.**

A mixture of unspecified parts of yerba mate, *Bulnesia sarmientoi* Lorentz ex. Griseb., and feathers of the flightless bird, *Rhea americana,* were used in fumigations by the Criollos of Chaco, northwestern Argentina, to treat aire (Scarpa 2004). The smoke was inhaled once a day for 9 days.

Imperata cylindrica

***Imperata cylindrica* (L.) P. Baeuv. (Poaceae).**
blady grass.

The roots of this species were burned in Mizoram, India, to generate smoke that was inhaled as an emollient for piles (hemorrhoids) (Mahanti 1994). In Cambodia, the rhizomes were burned for this same purpose (Menaut 1929). The natives of Groote Eylandt, an island to Australia's north, were fumigated with this species to cure "madness" (Levitt 1981). The plant was placed on a fire while patients were dipped in water. They were then covered with paper bark and made to stand next to the fire. They were "smoked" until they became quiet. Children were treated with the smoke in their mother's arms.

***Indigofera schimperi* Jaub. & Spach (Fabaceae). indigo.**

The roots or leaves of this species, when burned, generate smoke that was considered useful as a fumigant for reducing sudden fevers in natives of East Africa (Heine and Legére 1995). The Swahili name for the plant is *mwino* (ink plant).

***Indigofera* sp. (Fabaceae). indigo.**

In Madagascar, all parts of an unspecified species of *Indigofera* were burned to produce smoke that was inhaled to relieve pain (Mohagheghzadeh et al. 2006).

***Inula conyza* DC. (Asteraceae). plowman's spikenard.**

In ancient Egypt, the stems of this species were burned and used as a fumigation to drive insects away (Manniche 1989).

***Inula dysenterica* L. (Asteraceae). middle fleabane.**

According to Grieve (1971), the smoke produced by burning this plant was considered useful in unspecified parts of the world to drive away fleas and other insects, hence its common name, fleabane.

***Inula graveolens* Desf. (Asteraceae). cape khakiweed.**

The stems of this species were burned in ancient Egypt to produce a fumigant that was used to drive insects away (Manniche 1989).

***Inula helenium* L. (Asteraceae). elf dock.**

Dried leaves were burned in unspecified parts of the world for their smoke, which drove insects away, killed aerobic and airborne parasites, and served as an external antiseptic (Schneider 2002).

***Inula racemosa* Hook. f. (Asteraceae). showy elecampane.**

The roots were burned as incense in India's Lahoul Valley (northwestern Himalayas) (Sood et al. 2001). The Indian name for the species is *manurucha*.

***Inula viscosa* (L.) Ait. (Asteraceae). sticky fleabane.**

Unspecified parts of this plant have been reported to repel mosquitoes by the smoke it generates when burned (McIndoo 1924).

***Ipomoea crassipes* Hook. (Convolvulaceae). morning glory.**

The Zulu of South Africa used the smoke of burning roots as protective or fertility charms for their fields (Gerstner 1939).

***Ipomoea hildebrandtii* Vatke ssp. *grantii* (Bak.) Verdc. (Convolvulaceae). Mwase.**

In Bulamogi County, Uganda, the roots were smoked to keep spirits at bay (Tabuti et al. 2003).

***Ipomoea kituensis* Vatke. (Convulvulaceae). Ipomoea.**

Smoke generated in saunalike chambers was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Ipomoea leptophylla* Torr. (Convolvulaceae). bush morning glory.**

The roots of this species were burned to produce smoke that the Pawnee of North America used to stop nervousness and bad dreams (Gilmore 1919).

***Ipomoea paniculata* (L.) R. Br. (Convolvulaceae). giant potato.**

According to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), this species was one of several ingredients that was burned to produce smoke to cause blindness to one's enemies (see recipe 1 under *Asparagus racemosus* Willd.) (Sensarma 1998).

***Ipomoea pellita* Hallier. f. (Convolvulaceae). ground morning glory.**

The Zulu of South Africa used the smoke of burning roots as a protective or fertility charm for their fields (Gerstner 1939).

***Ipomoea purpurea* (L.) Roth. (Convolvulaceae). common morning glory.**

Like *I. pellita* Hallier. f., the Zulu burned the roots to protect their fields (Gerstner 1939).

***Ipomopsis multiflora* (Nutt.) V. Grant. (Polemoniaceae). many-flower ipomopsis.**

The Zuñi of North America smoked this plant in cigarettes rolled in corn husks to relieve strangulation (Stevenson 1909). The Zuñi name for the plant is *ha'silililiwe li'anna,* meaning "blue leaves in delicate motion."

***Iris missouriensis* Nutt. (Iridaceae). Rocky Mountain iris.**

The shamans of the Klamath of North America sometimes mixed the dried roots of this species with tobacco (*Nicotiana* spp.) and poison camas (probably *Camassia* spp.) and gave it to their patients to smoke and make them feel nauseous. This often prompted the patients to request and pay the shamans for additional services (Coville 1897).

Ipomoea purpurea

***Iris versicolor* L. (Iridaceae). harlequin blueflag.**

According to Smith (1932), Native Americans from all over the United States fumigated their clothes with this species to help them avoid snakebites during snake dances. The belief was that snakes would not strike them if their clothes were treated with the smoke of this species.

***Irvingia malayana* Oliv. (Irvingiaceae). dika nut.**

This species was traditionally used in Malaysia and Indonesia, where the fat of the seeds was considered useful for the preparation of scented candles (Uphof 1968).

***Isotoma petraea* F. Muell. (Campanulaceae). rock isotome.**

The leaves of this species were used in the Northern Territory of Australia to produce smoke that was considered useful for treating respiratory illnesses in adults (Barr 1993).

***Jacaranda copaia* D. Don (Bignoniaceae). Jacaranda.**

The Wayápi of French Guiana used the smoke produced by burning the leaves to repel flies (Grenand et al. 1987).

***Jacaranda copaia* D. Don ssp. *spectabilis* (DC.) A. Gentry. (Bignoniaceae). Jacaranda.**

In parts of Brazil, it was believed that the leaves and bark of this subspecies of the jacaranda could be burned to produce smoke that kept illness and mosquitoes away (Rutter 1990).

***Jasminum floribundum* R. Br. ex Fresen. (Oleaceae). jasmine.**

In Ethiopia, wood was burned to generate smoke considered useful to treat skin diseases and as an antihelmintic agent (Mohagheghzadeh et al. 2006).

***Jasminum* sp. (Oleaceae). jasmine.**

In an ancient Sanskrit treatise called the *Arthaśāstra of Kautilīya* (fourth century B.C.), an unspecified species of jasmine was listed as one of several ingredients in a concoction burned to produce smoke that was used to blind one's enemies (Sensarma 1998).

***Jatropha curcas* L. (Euphorbiaceae). physic nut.**

In Guam, the seeds were burned to produce smoke that was used to treat the eye condition mydriasis (Ross 2003). The Darien of Panama and others of Isthmian America used the smoke as a fumigant to repel bedbugs (Duke 1968; Duke 1986).

***Jatropha gossypifolia* L. (Euphorbiaceae). bellyache bush.**

The smoke produced by burning the leaves of the bellyache bush was used as a house disinfectant in Curaçao (Morton 1968).

***Jaubertia aucheri* Guill. (Rubiaceae). khurman.**

Near the southern Pakistan region of Kharan, the people burned the leaves of khurman and inhaled its smoke to relieve sore throats and to treat scurvy (Goodman and Ghafoor 1992).

***Jouvea pilosa* Scribn. (Poaceae). cocásjc.**

The Seri of Mexico and some parts of the United States considered this one of the best plant species for producing smoke signals (Felger and Moser 1985).

***Julbernardia globiflora* (Benth.) Troupin (Fabaceae). muwa.**

The Sukuma tribe of Tanzania, Africa, pounded the stems of this species and then smoked them in a pipe to treat leprosy (von Reis and Lipp 1982).

***Juniperus communis* L. (Cupressaceae). common juniper.**

Hippocrates of Cos, Greece, recommended that the smoke of burning juniper berries, along with other plants, be used as a fumigant (Allen and Hatfield 2004), which was said to have liberated Athens from the plague of 430 B.C. (see Introduction for more details; Pinault 1992; Schneider 2002; Thompson 2003). In Britain, from Devon to Colonsay, the Inner Hebrides burned green branches and berries to produce smoke that was used to purify and air-out sickrooms (McNeil 1910; Lafont 1984). In the Ubage Valley of France, the people inhaled the smoke of burning juniper berries to treat rheumatism and used the smoke produced by burning boughs as a disinfectant (Novaretti and Lemordant 1990). The smoke from burning branches, which were lit on Christmas Eve in Tuscany and elsewhere in Italy, was used to ward off the evil eye (Pieroni and Giusti 2002). The Woodland Cree of North America smoked the blue berries in a pipe to treat asthma (Leighton 1985). The Dena'ina of Alaska burned the leaves as incense and inhaled it to treat colds (Kari 1995). According to Avicenna, the wood was burned to produce an abortifacient smoke (Mohagheghzadeh et al. 2006).

Juniperus communis

***Juniperus communis* L. ssp. *nana* (Cupressaceae). common juniper.**

In the Poonch District of India, where the name for this plant is *bitru,* the leaves were burned as incense (Kirn et al. 2000).

***Juniperus communis* L. var. *depressa* Pursh. (Cupressaceae). common juniper.**

This species was burned to fumigate and air-out sickrooms (Trousseau and Pidoux 1841). No details about the users or their country were given.

***Juniperus communis* L. var. *montana* Ait. (Cupressaceae). common juniper.**

The Ramah Navajo of North America dried the fruits and then added them to tobacco (*Nicotiana* spp.) to enhance its flavor (Vestal 1952). The species reported in original texts was *Juniperus sibirica* Burgsd. (see Moerman 1998).

***Juniperus drupacea* Labill. (Cupressaceae). juniper.**

The ancient Egyptians often used the branches of this juniper to grill their food because the smoke it produced gave the food a pleasant aroma (Manniche 1989). The branches were also used as general fumigants.

***Juniperus excelsa* Willd. (Cupressaceae). Greek juniper.**

The leaves were burned as incense in Khorasan, Iran (Hooper and Field 1937).

***Juniperus horizontalis* Moench (Cupressaceae). creeping juniper.**

Juniperus horizontalis

According to Wassanaer (1625), the wood was burned in the New Netherlands for its pleasant odor. The whole house was perfumed with it. Smoke from burning twigs was inhaled by the Plains tribes of North America for treating head colds (Youngken 1924). The smoke of this species was also used to repel mosquitoes (McIndoo 1945). In North America, the Cheyenne burned the leaves as incense during ceremonies that were meant to drive away thunder (Hart 1981). Smoke from the leaves was also used to help with childbirth by promoting delivery. The Crow produced smoke from the species during certain incantations (Blankinship 1905).

***Juniperus indica* Bertol. (Cupressaceae). Indian juniper.**

This was another of the long list of species whose leaves were burned as incense in Nepal (Pohle 1990; Manandhar 2002).

***Juniperus macropoda* Boiss. (Cupressaceae). pencil cedar.**

High in the Karakoram Mountains of northern Pakistan live a mountain people called the Hanzakut. In their tiny communities, the shamans, called *bitans,* practice a unique ritual to commune with supernatural beings. The bitan inhales smoke from burning juniper bushes, dances to local music, and drinks the blood of a freshly decapitated goat head (Sidky 1994). The ecstatic, trancelike state induced during the ritual is almost certainly caused by hallucinogenic compounds in the smoke. The whole plant is used as incense throughout the Ladakh region of India according to Bhattacharyya (1991). In India's Lahoul Valley (northwestern Himalayas), religious healers of the Yurnat tribe threw a pinch of pulverized leaves into fires to drive away evil spirits from the bodies of their patients (Sood et al. 2001). This practice was usually accompanied by the chanting of mantras by the "Lamas." The whole plant was considered sacred in parts of India, where the leaves and twigs were often burned as a type of incense known as *dhup* (Dhiman 2003).

***Juniperus monosperma* (Engelm.) Sarg. (Cupressaceae). one-seed juniper.**

The Ramah Navajo of North America smoked various parts of this plant to help with difficulties during childbirth (Vestal 1952). The Shoshone, also of North America, inhaled the smoke from burning branches for treating colds (Train et al. 1941). The Western Keres used wood smoke to fumigate the properties of deceased tribal members (Swank 1932).

***Juniperus occidentalis* Hook. (Cupressaceae). western juniper.**

Juniperus occidentalis

The Paiute of North America burned the twigs of this species and inhaled the fumes to treat headaches and colds (Train et al. 1941). The fumes from burning branches were used to fumigate dwellings after illness. Horses that had eaten poison camas (probably *Camassia* spp.) were treated by having them to inhale the fumes (Mahar 1953). The Washoe of North America inhaled the fumes from burning twigs for headache relief (Train et al. 1941).

***Juniperus osteosperma* (Torr.) Little (Cupressaceae). Utah juniper.**

The Paiute of North America inhaled the smoke of burning twigs for the relief of headaches and smoke from burning the branches to treat colds (Train et al. 1941). The species reported in the original texts was *J. utahensis* (Engelm.) Lemmon (see Moerman 1998). The Northern Paiute burned the leaves and inhaled the smoke to cure colds (Fowler 1989) and burned the branches to fumigate houses after illness had occurred there (Train et al. 1941). The Yavapai, also of North America, used the smoke of smoldering leaves to fumigate a woman immediately after she had given birth (Peattie and Landacre 1991).

***Juniperus phoenicia* L. (Cupressaceae). Phoenician juniper.**

The ancient Egyptians often used the branches to grill their food because the smoke gave it a pleasant aroma (Manniche 1989). The branches were also used as general fumigants.

***Juniperus pinchotti* Sudw. (Cupressaceae). Pinchot's juniper.**

The Comanche of North America sprinkled dried leaves on their coal fires and inhaled the smoke to get relief from headaches, ghost sickness, and vertigo (Jones 1968).

***Juniperus procera* Hochst. &Endl. (Cupressaceae). African juniper.**

The Chamus of Kenya burned the bark during ceremonies to create a pleasant aroma in the air (Heine and Heine 1988a). The Marakwet, also of Kenya, inhaled the smoke produced by burning unspecified parts of this plant to help expel mucous membrane secretions (expectorant) (Lindsay 1978).

***Juniperus recurva* Buch.-Ham. ex. D. Don. (Cupressaceae). Himalayan juniper.**

In India (Chopra et al. 1956; Kirn et al. 2000) and Tibet (Tsarong 1986), smoke from burning green wood was inhaled to induce vomiting. The stems were burned as incense by members of India's Gabbi tribe of the Himachal Pradesh State of the western Himalayas (Singh and Kumar 2000). Both the leaves and wood were harvested for similar use in Nepal (Manandhar 2002). In the Sikkim Himalayas of India, the smoke from burning leaves and twigs was used to drive mosquitoes and other insects away (Pandey 1991).

***Juniperus scopulorum* Sarg. (Cupressaceae). Rocky Mountain juniper.**

The leaves of this species were burned by the Cheyenne of North America as incense (Hart 1981). The smoke was believed to protect them from thunder and lightning. They also used the smoke to promote delivery during childbirth. The Flathead of North America used the smoke to purify the air, ward off illness, and cure sick horses (Hart 1996). The Kutenai inhaled the smoke to treat colds (Hart 1996), and the Montana Indians burned the twigs during their ceremonies (Blankinship 1905). The Thompson (Turner et al. 1990) and Okanagan-Colville (Turner et al. 1980) used the species to fumigate their houses after sickness and death.

***Juniperus sibirica* Burgsd. (Cupressaceae). Siberian juniper.**

The Ramah Navajo of North America dried the fruits and added them to tobacco (*Nicotiana* spp.) to enhance its flavor (Vestal 1952). Moerman (1998) suggests that the species used was probably *Juniperus communis* L. var. *montana* Ait.

***Juniperus silicicola* (Small). L. H. Bailey (Cupressaceae). southern red cedar.**

The Seminole of North America burned the leaves to fumigate their bodies for eagle sickness, fawn sickness, and ghost sickness (Sturtevant 1955). Smoke from the entire plant was used to fumigate the body to treat insanity. The actual species

used was probably *Juniperus virginiana* L. var. *silicicola* (Small) J. Silba according to Moerman (1998).

***Juniperus* spp. (Cupressaceae). juniper.**

The Comanche of North America burned the leaves of an unspecified species of juniper, inhaling the smoke for its purifying effects (Carlson and Jones 1939). The Dakota, Omaha, and Pawnee, also of North America, inhaled smoke from burning juniper twigs to treat colds (Gilmore 1919). The latter also inhaled the smoke to calm their nerves and to stop bad dreams. Other Native American tribes reported uses for junipers. The Salish burned entire plants for unspecified fumigation purposes (Teit 1930). The Kiowa burned the needles as incense during prayers (Vestal and Schultes 1939). In Denmark's Faeroe Islands, the wood of junipers was used to smoke meat (Milliken and Bridgewater 2004). On the Isle of Colonsay in northwestern Scotland, junipers were once burned to fumigate houses and stables to cleanse them of pests, diseases, and evil spirits. They were burned in Nepal for smoke that was used in the puja ceremony, which was often held before attempts were made to climb Mt. Everest.

***Juniperus squamata* Buch.-Ham. (Cupressaceae). flaky juniper.**

The leaves were considered useful for burning as incense in Nepal (Manandhar 2002).

***Juniperus utahensis* (Engelm.) Lemmon (Cupressaceae). Utah juniper.**

The Paiute of North America inhaled the smoke of burning twigs for relieving headaches and smoke from the branches to treat colds (Train et al. 1941). Moerman (1998) suggests that the species actually used was probably *Juniperus osteosperma* (Torr.) Little.

***Juniperus virginiana* L. (Cupressaceae). eastern red cedar.**

The smoke of red cedar was often used by an unspecified group of people for incense purposes according to Usher (1974). The Dakota, Omaha, Ponca, and Pawnee of North America burned the twigs of this species to generate smoke that was inhaled to relieve head colds (Gilmore 1919). The smoke from burning twigs was inhaled elsewhere to eliminate nervousness and bad dreams (Lewis and Elvin-Lewis 2003). The Comanche of North America used the smoke from burning leaves as a purifying agent (Carlson and Jones 1939), and the Creek of North America used it for relieving cramps in neck muscles (Swanton 1927). Many Native American tribes used the species for incense purposes, especially during purification ceremonies and rituals (Kindscher 1992). In other places, the smoke from burning oil and wood was used to repel a variety of insects (Huddle 1936; Sievers and Higbee 1942; McIndoo 1945; Jacobson 1958). The Native Ozarker of America's Midwest burned cedar sprigs as incense and as an inhalant during purifying baths that were meant for the relief of bronchial problems (Liebert 1987). The smoke is, apparently, also useful as a fumigant that can relieve the itchiness caused by contact with poison ivy (probably a species of *Toxicodendron*) (Liebert 1987).

Juniperus virginiana

***Juniperus virginiana* L. var. *silicicola* (Small) Silba (Cupressaceae). southern red cedar.**

The Seminole of North America burned the leaves to fumigate their body for eagle sickness, fawn sickness, and ghost sickness (Sturtevant 1955). Smoke from the entire plant was used to fumigate the body to treat insanity. The species reported by Sturtevant (1955) was probably *Juniperus silicicola* (Small). L. H. Bailey (see Moerman 1998).

***Juniperus virginiana* L. var. *virginiana* (Cupressaceae). eastern red cedar.**

The Kiowa of North America burned the needles of this species for incense purposes during the prayer sessions of peyote meetings (Vestal and Schultes 1939). The species originally reported was *Sabina virginiana* Antoine.

***Juniperus wallichiana* Hook. f. ex Parl. (Cupressaceae). hapushe.**

The twigs were used as incense and to repel evil spirits in Hawan, India (Kapur 1996a).

***Jurinea dolomiaea* Boiss. (Asteraceae). dhoop.**

Members of the Gaddi tribe of India's Himachal Pradesh State in the western Himalayas collected the roots for the preparation and use of incense materials (Singh and Kumar 2000). The plant was considered sacred in other parts of India and was often used as incense in shrines and religious ceremonies (Dhiman 2003). In Nepal, an unspecified group of people burned the whole plant as incense (Manandhar 2002).

***Jurinea macrocephala* DC. (Asteraceae). gogol dhoop.**

In the Himachal Hills of India, the leaves were burned as incense during religious ceremonies (Sharma and Rana 2000).

***Justicia adhatoda* L. (Acanthaceae). malabar nut.**

Members of the Jatapus and Savaras tribes of India's Eastern Ghats area in the Andhra Pradesh State inhaled the smoke of burning dried inflorescences for the treatment of asthma (Rama Rao and Henry 1996). In Sri Lanka, dried malabar nut leaves were rolled into cigarettes and smoked to relieve asthma (Jayaweera 1981a). This species was reported as *Adhatoda vasica* Nees. by Jayaweera (1981a).

***Justicia exigua* S. Moore (Acanthaceae). Justicia.**

The Samburu of Kenya fumigated and cleansed their containers with the smoke produced by burning this plant (Heine and König 1988a).

***Justicia zeylanica* T. Anderson (Acanthaceae). kawldai.**

The leaves were dried and then smoked to relieve asthma in India's Mizoram State (Lalramnghinglova 2003).

***Khaya* sp. (Meliaceae). African mahogany.**

Asita and Campbell (1990) reported that the wood of an unspecified mahogany could be burned to produce smoke that effectively inhibited three species of bacteria—*Staphylococcus aureus, Saccharomyces cerevisiae,* and *Eschirichia coli*—all of which are known to spoil food.

***Klainedoxa gabonensis* Pierre (Irvingaceae). eveuss.**

Along the banks of the Ubangi River of central Africa, patients suffering from lumbago treated the condition by fumigating the affected area with smoke from the burning bark of this species (Vergiat 1970).

***Kleinia* spp. (Asteraceae). Kleinia.**

The wood of this species was used as firewood in Ethiopia but only if more desired species were unavailable. This species was avoided because its smoke can irritate

the eyes, causing considerable damage over long periods of use (Getahun 1976). This species is known in Ethiopia as *kinchive*.

***Knowltonia anemonoides* H. Rasm. (Ranunculaceae). brandblaar.**

In parts of South Africa, smoke from burning leaves was inhaled for the relief of toothache (Schwegler 2003).

***Knowltonia anemonoides* H. Rasm. ssp. *anemonoides* (Ranunculaceae). brandblaar.**

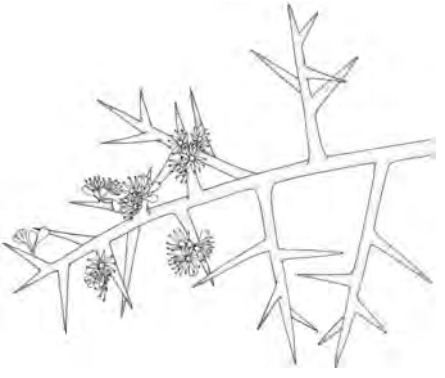
The Zulu of South Africa burned the leaves of this species and inhaled the smoke to relieve headaches (Hutchings et al. 1996).

***Knowltonia vesicatoria* Sims (Ranunculaceae). brandblaar.**

In South Africa, this species, known commonly as *brandblaar* in Afrikaans, was burned for smoke that was used to treat headaches (Hutchings et al. 1996).

***Koeberlinia spinosa* Zucc. (Capparaceae). crucifixion thorn.**

The Seri of Mexico burned the wood to produce smoke to disinfect their houses and to drive away disease during epidemics, probably measles (Felger and Moser 1974). The smoke is thick, black, and oily and is thought to be toxic.



Koeberlinia spinosa

***Kyllinga monocephala* Rottb. (Cyperaceae). bandarphool.**

In parts of China, the plant was burned to keep insects away (Bliss 1973).

***Lablab purpureus* (L.) Sweet ssp. *uncinatus* Verdc. var. *rhomboideus* (Schinz) Verdc. (Fabaceae). lablab bean.**

The roots of this species, along with those of other species, were used in Namibia to treat angina pectoris and other heart conditions (see *Annona stenophylla* Engl. & Diels.; von Koenen 2001).

***Lagenaria siceraria* (Mol.) Standl. (Cucurbitaceae). bottle gourd.**

The Seminole of North America smoked the seeds for treating insanity (Sturtevant 1955). This species also featured prominently in the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), where it was reportedly burned as part of a mixture that produced a deadly smoke used to kill animals (Sensarma 1998). Unspecified parts of this plant were mixed with those of other plants and animals (see recipe 4 under *Asparagus racemosus* Willd.).

***Lagerstroemia speciosa* (L.) Pers. (Lythraceae). pride of India.**

The seeds were often smoked with tobacco (*Nicotiana* spp.) in Mizoram, India, for their narcotic properties (Sharma et al. 2001).

***Lampaya medicinalis* Phil. (Verbenaceae). lampaya.**

Chile's pre-Altiplanic community burned the leaves and stems because they were believed to have anesthetic and sedative properties (Aldunate et al. 1983).

***Lancea tibetica* Hook. f. & Thomson (Scrophuliaraceae). Chinese milkwort.**

Powdered leaves of the Chinese milkwort were mixed with ghee and burned to make incense in India's Indus Valley (Ladakh region) (Singh et al. 1996).

***Lannea edulis* Engl. (Anacardiaceae). wild grape.**

The roots of this species, along with other unspecified species, were used in Namibia to treat angina pectoris and other heart conditions (see *Annona stenophylla* Engl. & Diels.; von Koenen 2001).

***Lannea stuhlmannii* Engl. (Anacardiaceae). false maroela.**

In Tanzania, the soft root hairs of this plant were smoked like cigarettes to treat ulcers in the nose (von Reis and Lipp 1982).

***Lansium domesticum* Corr. (Meliaceae). langsat.**

The peels or rinds of the fruits were considered useful for burning as incense by the Javanese of Indonesia (Uphof 1968; Sangat-Roemantyo 1990). In the Philippines, the smoke of burning fruits and fruiting bodies was used as a fumigant to repel mosquitoes (Grainge and Ahmed 1988).

***Lantana camara* L. (Verbenaceae). common lantana (figure 18).**

The dried leaves of this toxic plant were smoked to relieve headaches in East Africa (Heine and Legére 1995). This is not surprising given that the leaves of this species produce a phenylethanoid glycoside, dimethyl verbascoside, which has been shown to significantly affect activity in rat hearts (Pennacchio 1997; Syah et al. 1998).

Figure 18. *Lantana camara*. The leaves of this highly toxic species were smoked to treat headaches. Many useful medicinal plants are toxic when taken in high doses.

***Lantana rhodesiensis* Moldenke (Verbenaceae). Rhodesian lantana.**

In Kenya, up to 16% of the people surveyed by Ongore et al. (1989) used the smoke from the burning leaves of this species to repel mosquitoes.

***Lantana trifolia* L. (Verbenaceae). treeleaf shrub verbena.**

In the southern half of the Narok District of Kenya, the Loita Maasai, a group that still clings to the more traditional Maasai lifestyle, placed leaves of this species on fires to produce smoke that gives off aromatic smells. The smoke was generated within their animal enclosures to cleanse and bless livestock (Maundu et al. 2001). Also in Kenya, the Gabbra of the Marsabit District burned the species to fumigate and cleanse their gourds (Heine and Brenzinger 1988). This was also a common practice of the Borana of Ethiopia.

***Lantana viburnoides* Vahl. (Verbenaceae). Lantana.**

This species was used in several Tanzanian villages, including Mpirani, Tongoni, and Maranzara in Tanga District, and in the Sindeni village of Handeni District. The leaves were dried and powdered, after which they were burned. The smoke was inhaled to drive out the devil (Hedberg et al. 1983).

***Larix laricina* (Du Roi) K. Koch. (Pinaceae). tamarack.**

The Cherokee of North America burned the rotten wood of this species to smoke hides and to give them a yellow tint (Leighton 1985). The Flambeau Ojibwa, also of North America, burned the leaves and inhaled the fumes to treat various respiratory ailments (Smith 1932).

***Larix occidentalis* Nutt. (Pinaceae). western larch.**

The Kutenai of North America used the smoke generated from burning rotten wood to tan buckskins (Hart 1996).

***Larrea divaricata* Cav. subsp. *tridentata* (Sessé & Moc. ex DC.) Felger (Zygophyllaceae). creosote bush.**

The Seri of Mexico smoked insect galls among the foliage twigs of this species for pleasure (Felger and Moser 1985). The galls are produced by the creosote bush gall midge (*Asphondylia* sp).

***Larrea tridentata* Coville. (Zygophyllaceae). creosote bush.**

Eischen and Vergara (2004) tested the natural products in the smoke of this species on mortality of the honeybee (*Apis mellifera*) and tracheal mite (*Acarapsis woodi*). It exhibited significant mortality. The Pima of North America inhaled smoke from burning creosote bush to cure weakness and laziness (Curtin 1984).

***Larrea tridentata* Coville var. *tridentata* (Zygophyllaceae). creosote bush.**

The North American Papago used smoke from smoldering green branches to treat sore feet (Castetter and Underhill 1935). The limbs were held above the smoke. The species reported in original texts was *Covillea glutinosa* Rydb.

***Lasiosiphon anthylloides* Meisn. (Thymelaeaceae). Lasiosiphon.**

In Africa, smoke produced by burning this plant was inhaled to reduce fever and eliminate bad dreams (Watt and Breyer-Brandwijk 1962).

***Lasiosiphon capitatus* Burtt Davy (Thymelaeaceae). Lasiosiphon.**

The smoke of burning leaves was considered useful in Africa for the relief of headaches (Watt and Breyer-Brandwijk 1962).

***Lasiosiphon linifolius* Decne (Thymelaeaceae). Lasiosiphon.**

Like *L. capitatus,* the smoke of burning leaves was considered useful in Africa for the relief of headaches (Watt and Breyer-Brandwijk 1933).

***Laurelia sempervirens* (Ruiz & Pav.) Tul. (Monimiaceae). Chilean laurel.**

In south-central Chile, the Mapuche burned the bark of this species and inhaled the resultant smoke for the relief of convulsions (Houghton and Manby 1985).

***Laurus azorica* (Seub.) Franco. (Lauraceae). canary laurel.**

The leaves of this species were used in the Madeira archipelago to treat apoplexy (Rivera and Obón 1995).

***Laurus nobilis* L. (Lauraceae). bay laurel.**

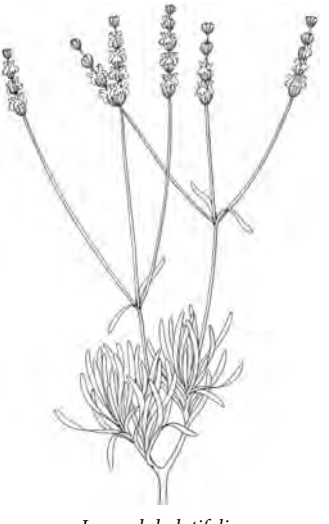
Smoke from burning bay laurel leaves may have been inhaled by ancient Greece's oracle at Delphi to induce a trancelike state during her divinations (Littleton 1986). The leaves may have been laced with *Cannabis sativa* L.

***Lavandula angustifolia* Mill. (Lamiaceae). common lavender.**

The smoke of this species, when burned, was used in the Madeira archipelago to treat apoplexy (Rivera and Obón 1995).

***Lavandula latifolia* Medik. (Lamiaceae). spike lavender.**

Smoke from burning inflorescences was inhaled to treat aire in La Paz and El Alto, Bolivia (Macía et al. 2005). It was also used to ease the pains of childbirth and for uterus ailments. In the latter two cases, smoke from the burning inflorescences was blown directly into the vagina.



Lavandula latifolia

***Lavandula pedunculata* (Mill.) Cav. (Lamiaceae). Spanish lavender.**

The leaves of this species were smoked in the Madeira archipelago for apoplexy (Rivera and Obón 1995).

***Lawsonia inermis* L. (Lythraceae). henna.**

Smoldering wood was used to fumigate and flavor the insides of milk gourds according to the Pokot of northern Kenya (Timberlake 1987). The local name for the species is *kaparamenion*.

***Ledum groenlandicum* Oeder (Ericaceae). Labrador tea.**

The Parry Island Ojibwa near Lake Huron in North America smoked the leaves of this species when tobacco (*Nicotiana* spp.) was scarce (Jeaness 1935).

***Ledum palustre* L. (Ericaceae). crystal tea.**

In eastern Kazakhstan, Russia, Siberia, and Ukraine, the leaves of this plant were sometimes burned as a fumigant to drive away insects (Minaeva 1991).

***Leonotis leonurus* (L.) R. Br. (Lamiaceae). lion's tail.**

In 1925, Dornan reported that the Kalahari Bushmen of South Africa were addicted to smoking this species, which they called *dacha*. The Nama of South Africa were also reported to have smoked the leaves for recreational purposes (Smith 1966). The Hottentots of South Africa smoked the buds and leaves for their narcotic effects (Schultes et al. 2001). The resin produced by the plant was sometimes mixed and smoked with tobacco (*Nicotiana* spp.). The plant was smoked for the relief of epilepsy in other parts of South Africa (Schwegler 2003).

Leonotis leonurus

***Leonotis nepetifolia* (L.) R. Br. (Lamiaceae). Christmas candlestick.**

In Bulamogi County, Uganda, the leaves were smoked in banana stem pipes to help men divorce their wives (Tabuti et al. 2003).

***Leonotis sibericus* L. (Lamiaceae). Siberian motherwort.**

This species was mentioned in the *Chinese Book of Songs, Shih Ching,* but it was smoked in Central and South America (Schultes et al. 2001). Dried leaves were harvested from flowering plants and were then smoked as a cannabis substitute.

***Lepidium ruderale* L. (Brassicaceae). wild peppergrass.**

The whole plant, when burned, produces smoke that was considered useful for repelling a variety of insects, including aphids, beetles, and mites (McIndoo 1945).

***Lepidium sativum* L. (Brassicaceae). garden cress pepperweed.**

According to Avicenna, the fumes of burning fruits were used in Iran as pest repellents (Mohagheghzadeh et al. 2006).

***Leptodermis lanceolata* Wall. (Rubiaceae). Leptodermis.**

The leaves and flowers were burned as incense in Nepal (Manandhar 2002).

***Leucas martinicensis* (Jacq.) R. Br. (Lamiaceae). wild tree bush.**

Unspecified parts of this species were burned so that the smoke generated could be employed as a fumigant that repelled mosquitoes (Jacobson 1975).

***Leucas pechuelii* Baker (Lamiaceae). erombora.**

Known in Namibia by the Himba as *erombora,* the leaves were often burned on embers in the preparation of smoke baths that were used for treating dizziness and fainting spells (von Koenen 2001). In the Omuhonga Mountains of Namibia, the leaves were burned in combination with the leaves of *Mundulea sericea* (Willd.) A. Chev. to produce smoke that was inhaled to treat furuncules (von Koenen 2001).

***Ligusticum canadense* Britt. (Apiaceae). Canadian licorice root.**

The Cherokee of North America smoked the roots to treat various disorders of the stomach (Sturtevant 1955).

***Ligusticum canbyi* Coult. & Rose (Apiaceae). canby's licorice root.**

The Flathead of North America smoked the roots to stop seizures (Hart 1996). The Okanagan-Coville used the smoke of the roots to revive a singer during a ceremonial trance (Turner et al. 1980). It was also used to revive a person affected by the "blue jay spirit." The Crow sprinkled shavings of the roots on live coals for incense purposes. They also mixed the shavings with tobacco (*Nicotiana* spp.) for their kinnikinnick. The Okanagan-Coville mixed the roots with tobacco to give it a menthol taste.

***Lindera fragrans* Oliv. (Lauraceae). bamboo-leaf spicebush.**

In China, the leaves were burned with the roots of *Thuja orientalis* L. as incense (Henry 1893).

***Lindera* sp. (Lauraceae). spicebush.**

The leaves were burned as incense in China (von Reis and Lipp 1982).

***Linum lewisii* Pursh (Linaceae). prairie flax.**

The Kayenta Navajo of North America used the plant's smoke as a fumigant for unspecified purposes (Wyman and Harris 1951).

***Liparis vexillifera* (Llave & Lex.) Cogn. (Orchidaceae). tropical widelip orchid.**

The Huichol of Mexico's Jalisco and Nayarit States often added the flowers of this orchid to their tobacco (*Nicotiana* spp.) and smoked the mixture during the Peyote Pilgrimage ceremony (Bauml 1994).

***Lippia alba* (Mill.) N.E.Br. ex Britton & P. Wilson (Verbenaceae). juanilana.**

The Carib of Guatemala inhaled the smoke of burning leaves to relieve nausea and vomiting (Gíron et al. 1991). In Livingston, Izabal, and Guatemala, parts of the trunk were burned for incense purposes (Pöll et al. 2005).

***Lippia asperifolia* Rich. (Verbenaceae). Lippia.**

In parts of East Africa, where the Bantu language of Swahili is common, the leaves of this species were burned as incense (Heine and Legére 1995). The local name for this plant is *mpambd mke*.

***Lippia javanica* Sprenq. (Verbenaceae). common lippia.**

The leaves were burned in Zimbabwe for their smoke, which was considered useful for repelling mosquitoes (Lukwa et al. 1999).

***Lippia multiflora* Mold. (Verbenaceae). multiflowered lippia.**

This herb was burned in Gambia, where the smoke was used to fume beehives. This attracted the bees (Dalziel 1937).

***Lippia nodiflora* (L.) Michx. (Verbenaceae). fog fruit.**

In Libya, the plant was compressed between two red-hot bricks to produce smoke that was used to fumigate and treat inflamed and bleeding piles (Hussein 1985).

Lippia alba

***Lippia* sp. (Verbenaceae). Lippia.**

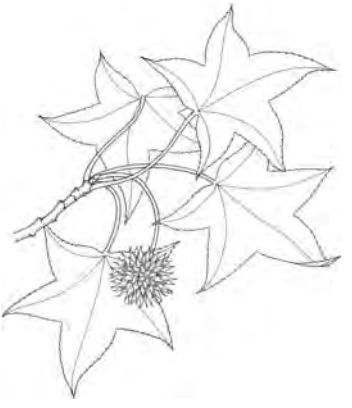
An unspecified species of lippia was burned in Gambia, Africa, where its smoke was used to repel mosquitoes (Aikins et al. 1994).

***Liquidambar orientalis* Mill. (Hamamelidaceae). Oriental sweetgum.**

The semisolid gum (levant storax) produced by this species was burned in western Asia and Asia Minor as a fumigant for unspecified purposes (Uphof 1968; Usher 1974).

***Liquidambar styraciflua* L. (Hamamelidaceae). sweetgum.**

In Cyprus, both the bark and the wood of this plant played an important role in the orthodox liturgy during which it was burned as incense (Georgiades 1987b). Its importance to this religious Cypriote rite can be inferred from the local name for the species, *xylon tau Aphenti,* or "wood of the Lord." Resin from the trunk of this plant was burned in Central and North America as a fumigant for unspecified purposes (Uphof 1968; Usher 1974). The resin, known as American storax, was also a highly prized forestry product of the Aztec of Mexico. They burned it as incense and often mixed it with their tobacco (*Nicotiana* spp.) (Alcorn 1984). It is believed to have been of such importance to the Aztecs that when Spanish conquistador Hernando Cortés met with Aztec Emperor Montezuma II in 1519, the latter inhaled smoke from a tobacco and sweetgum mixture (Díaz del Castillo 1956). American storax was used by the U.S. tobacco industry to flavor its cigarettes (Tyler et al. 1988).



Liquidambar styraciflua

***Litsea glutinosa* (Lour.) C. B. Rob. (Lauraceae). Indian laurel.**

In the Northern Territory of Australia, smoke from burning crushed leaves was inhaled by indigenous Australians for nausea (Barr 1993).

***Lobelia cardinalis* L. (Campanulaceae). red lobelia.**

Ross (2002) suggests that the dried leaves and flowers can be mixed with other herbs and smoked for pleasure. Only a pinch of plant material is recommended.

***Lobelia excelsa* Bonpl. (Campanulaceae). Lobelia.**

The leaves were smoked for unspecified purposes in India (Lewis and Elvin-Lewis 2003).

***Lobelia inflata* L. (Campanulaceae). Indian tobacco.**

Prior to the arrival of European colonizers, the leaves were smoked during Hocak (Winnebago) ceremonies and on a daily basis for recreational purposes (Kindscher and Hurlburt 1998). The smoke from burning leaves was inhaled by Native North Americans to treat asthma, as a stimulant and expectorant (Kavasch 1979). Tierra (1983) reported that the leaves were also smoked to help stop smoking tobacco (*Nicotiana* spp.). This was certainly the case with the Cherokee of North America (Hamel and Chiltoskey 1975). They also used it to smoke out gnats.

Lobelia inflata

***Lobelia tupa* L. (Campanulaceae). devil's tobacco.**

The leaves, which were known to be toxic by its users, were smoked for their psychoactive effects by the Mapuche of southern Chile (Schultes et al. 2001).

***Lolium temulentum* L. (Poaceae). darnel rye grass.**

In parts of Iran, the whole plant was burned to produce smoke that, according to Avicenna, was inhaled to treat general gynecological disorders (Mohagheghzadeh et al. 2006).

***Lomatia silaifolia* (Sm.) R. Br. (Proteaceae). wild parsley.**

The flowers of the wild parsley, when burned, produce smoke that has been reported to repel flies (McIndoo 1945).

***Lomatium dissectum* (Nutt.ex Torr. & A. Gray) Mathias & Constance. (Apiaceae). fernleaf bisquitroot.**

The Nez Perce of North America mixed the roots with tobacco (*Nicotiana* spp.) and smoked them to treat sinus troubles (Hart 1996). The Northern Paiute, also of North America, mixed the roots with tobacco and smoked the mixture to relieve headaches and colds (Fowler 1989). Other Native Americans inhaled the smoke of burning roots to treat influenza, sinus, sore throats, congestion in the nose and lungs, hay fever, bronchitis, asthma, pneumonia, headaches, dizziness, and tuberculosis (Foster and Hobbs 2002).

***Lomatium dissectum* (Nutt.ex Torr. & A. Gray) Mathias & Constance. var. *multiflorum* (Apiaceae). carrot-leaf bisquitroot.**

The Blackfoot, Ute, and Gosiute of North America burned the roots of this species and let their horses inhale the smoke to treat distemper (Chamberlin 1909). The Great Basin people, also of North America, burned dried roots on hot coals, inhaling the smoke for asthma and bronchitis, and the Paiute of North America inhaled smoke from burning pulverized roots for colds, asthma, and tuberculosis (Train et al. 1941). Moerman (1998) suggests another plant species may have been used in these practices.

***Lomatium macrocarpum* (Nutt. ex Torr. & Gray) Coult. & Rose (Apiaceae). big-seed bisquitroot.**

The Blackfoot of North America burned the roots and used the smoke to treat distemper in their horses (Hart 1996). The Crow, also of North America, threw shavings of the roots on hot coals for incense purposes that were meant to purify and scent the air.

***Lomatium nudicaule* Coult. & Rose (Apiaceae). bare-stem bisquitroot.**

The Saanich, Songish, and Cowichan of Canada burned the seeds to fumigate and thus drive evil spirits from their houses (Turner and Bell 1971).

***Lonchocarpus capassa* Rolfe (Fabaceae). lance tree.**

Traditional healers in Tanzania used this species to treat epilepsy. Patients were covered with a blanket and made to inhale the smoke produced by burning leaves (Mushi et al. 2005).

***Lonchocarpus nelsii* (Schinz) Schinz ex Heering & Grimme ssp. *nelsii* (Fabaceae). apple leaf.**

The smoke produced by burning the roots on glowing coals was inhaled in parts of Namibia to treat colds (von Koenen 2001).

***Lonicera floribunda* Boiss. & Buhse. (Caprifoliaceae). Euch-ghad.**

The leaves of this species were burned in Iran for a fumigant that could relieve pain, especially from toothache (Ghorbani 2005).

***Lupinus* sp. (Fabaceae). lupine.**

The Blackfoot of North America burned an unspecified species of lupine for incense purposes during the Ghost Dance (Hellson 1974).

***Lycopodium clavatum* L. (Lycopodiaceae). club moss.**

The Sotho of South Africa mixed whole plants with *Selaginella caffrorum* (Milde) Hieron., and sometimes with *Selaginella wightii* Hieron. and smoked the mixture to treat headaches (Jacot Guillarmod 1971).

Lycopodium clavatum

***Lycopodium* sp. (Lycopodiaceae). club mosses.**

The Iroquois of North America sprinkled the spores of an unspecified species of club moss on fires to stop nosebleeds (Herrick 1977).

***Lysichiton americanus* Hultén & St. John. (Araceae). American skunk cabbage.**

The smoke of burning roots was inhaled by Native North Americans to treat influenza and rheumatism and to promote pleasant dreams (Smith 1929; Foster and Hobbs 2002). This species was reported as *L. kamtschatcense* Scott. (Moerman 1998).

***Lysichiton kamtschatcense* Schott. (Araceae). skunk cabbage.**

The roots of this member of the arum family were burned by the Bella Coola and neighboring tribes of British Columbia, Canada, to produce smoke, which was inhaled for bad dreams, influenza, and rheumatism (Smith 1929). The roots are considered poisonous. See *Lysichiton americanus* Hultén & St. John.

***Lysimachia vulgaris* L. (Primulaceae). garden yellow loosestrife.**

According to Grieve (1971), this species, which is not related to purple loosestrife, was burned in houses in an unspecified country to drive away gnats.

***Macromeria viridiflora* DC. (Boraginaceae). giant trumpets.**

The Hopi of North America used the smoke of burning giant trumpets to treat insane people (Whiting 1939). The species reported in original texts was its synonym, *Onosmodium thurberi* A. Gray.

***Macropiper excelsum* (G. Forst.) Miq. (Piperaceae). New Zealand pepper tree.**

The Maori of New Zealand tossed the leaves of this plant, known locally as *kawakawa,* into their campfires because it produces an acrid smoke that kept mosquitoes and sand flies away (Stark 1979).

***Madhuca latifolia* J. F. Macbr. (Sapotaceae). Indian butter tree.**

Several parts of this plant have been burned to repel a variety of insects and other pests (McIndoo 1945).

***Madia glomerata* Hook (Asteraceae). mountain tarweed.**

The Crow of North America burned dried herbs for incense purposes during certain ceremonies (Blankinship 1905).

***Maerua caffra* Pax. (Capparaceae). bush cherry.**

South African Vendan women suffering from menorrhagia exposed their vulva to smoke from burning roots. The smoke was also inhaled to relieve headaches (Arnold and Gulumian 1984).

***Maerua crassifolia* Forssk. (Capparaceae). Maerua.**

In Kenya, the Chamus (Heine and Heine 1988a), Rendille (Heine and Heine 1988b), Gabbra (Heine and Brenzinger 1988), and the Borana of Ethiopia (Heine and Brenzinger 1988) burned the sticks of this species to fumigate their contain-

ers to give them a pleasant aroma. Wickens (2004) reported that the smoke was obnoxious.

***Maerua kaessneri* Gilg and Benedict (Capparaceae). Maerua.**

Gourds were fumigated and cleansed with the smoke of this species by the Borana of Ethiopia and by the Gabbra of Kenya (Heine and Brenzinger 1988).

***Maerua subcordata* (Gilg.) DeWolf. (Capparaceae). chepuluswo.**

The Pokot of northern Kenya believed that the smoke of burning leaves could stop earthquakes (Timberlake 1987). *Chepuluswo* is the local name for this species.

***Maianthemum canadense* Desf. (Convallariaceae). Canadian mayflower.**

The Flambeau Ojibwa of North America used parts of this plant to produce smoke that was inhaled for unspecified purposes (Smith 1932).

***Maianthemum racemosum* (L.) Link ssp. *amplexicaule* (Nutt.) LaFrankie (Liliaceae). feathery false lily of the valley.**

Native North Americans burned the roots to produce smoke to revive an unconscious person (Krochmal and Krochmal 1973). This species was reported as *Smilacina amplexicaulis* (Nutt.) S. Wats. in the original texts.

***Maianthemum racemosum* (L.) Link. ssp. *racemosum* (Convallariaceae). Father Solomon's seal.**

This species, which was reported as *Smilacina racemosa* (L.) in original ethnobotanical texts (see Moerman 1998), was burned by the Chippewa of North America to produce smoke that was considered useful for relieving headaches and other pain (Gilmore 1933). The Potawatomi, also of North America, prepared a smudge of the roots to revive comatose patients (Smith 1933).

***Malva sylvestris* L. (Malvaceae). common mallow.**

The flowers and the leaves, when burned, produced smoke that was used in the Ubage Valley of France as an antiseptic (Novaretti and Lemordant 1990).

***Mangifera indica* L. (Anacardiaceae). mango.**

Smoke from burning leaves was considered useful in China for treating hiccups, asthma, and throat ailments (Jiangsu New Medical College 1979). In parts of India, the leaves of the mango were burned to generate smoke used for skin ailments (Mohagheghzadeh et al. 2006). The smoke from burning leaves was used in Papua New Guinea as a mosquito repellent (Vernede et al. 1994).

Mangifera indica

***Manihot esculenta* Crantz (Euphorbiaceae). cassava.**

The leaves were smoked in parts of the central African Congo to treat disorders of the respiratory tract (Mohagheghzadeh et al. 2006).

***Manilkara inundata* (Ducke) Ducke ex Monach. (Sapotaceae). Manilkara.**

Smoke from burning wood was used to cure rubber in parts of Colombia (von Reis and Lipp 1982).

***Mansoa standleyi* (Steyerm.) A. H. Gentry (Bignoniaceae). Mansoa.**

The Quichua of Ecuador burned the plant near where their chickens roosted. This was said to cure a variety of illnesses common to the animals (Alarcón 1988).

***Markhamia lutea* (Benth.) K. Schum. (Bignoniaceae). siala.**

The leaves were smoked in Bulamogi County, Uganda, to treat mental disorders (Tabuti et al. 2003).

***Mastixia arborea* C. B. Clarke (Cornaceae). kunthirikkam.**

The hill tribes of south India's Shola forests in Kerala State burned the resin obtained from this species to repel flies and mosquitoes (Kumar et al. 2000). *Kunthirikkam* is the species' local name.

***Matricaria chamomilla* L. (Asteraceae). chamomile.**

In Libya, the flower heads of chamomile were added to smoking tobacco (*Nicotiana* sp.) to enhance its flavor (Hussein 1985). The essential oils from this plant were used for this purpose in unspecified parts of Europe (Uphof 1968).

Matricaria chamomilla

***Maytenus undatus* (Thunb.) Blakelock. (Celastraceae). Maytenus.**

The Samburu of Kenya burned the small branches to fumigate and cleanse their gourds (Heine and König 1988a).

***Maytenus vitis-idaea* Griseb (Celastraceae). yaguareté nimbi.**

The Maka of the Paraguayan Chaco burned the branches and used the smoke as a fumigant for helping to make more efficient and deadly weapons and to propitiate game to be plentiful and fat (Arenas 1987).

***Melaleuca cajuputi* Powell (Myrtaceae). cajeput.**

The leaves were crushed and smoked by the people of Australia's Northern Territory to relieve nasal and bronchial congestion (Barr 1993).

***Melaleuca glomerata* F. Muell. (Myrtaceae). inland tea tree.**

The Pitjantjatjara of Australia burned the branches and inhaled the smoke for unspecified medicinal properties (Latz 1995).

***Melaleuca leucadendra* (L.) L. (Myrtaceae). broad leaved paperbark.**

In Australia's Northern Territory, smoke from young leaves was inhaled for colds, pain, fever, and general malaise (Barr 1993).

***Melaleuca symphyocarpa* F. Muell. (Myrtaceae). Australian liniment tree.**

Colds and influenza were treated by inhaling the smoke of crushed and burning young leaves (Barr 1993).

***Melanthera scandens* (Schumach. & Thonn.) Brenan (Asteraceae). Melanthera.**

In Mbeere, Kenya, this species was used to make fumigation torches that aired out stuffy huts and sickrooms (Riley and Brokensha 1988).

***Melilotus officinalis* (L.) Lam. (Fabaceae). yellow sweet clover.**

In Siberia (Minaeva 1991), Ukraine, and other parts of the former Soviet Union (USSR), the top leaves and flowers of yellow sweet clover were often mixed with poor-quality tobacco (*Nicotiana* spp.) to enhance its flavor (Kondratyuk et al. 1967). The Ukrainian name for the plant is *burkun likarskii;* its Siberian name is *donnik lekarstvennyi*.

***Meliosma buchananiifolia* Merr. (Sabiaceae). Meliosma.**

The bark was burned in southern China as incense (Uphof 1968).

***Mentha aquatica* L. (Lamiaceae). water mint.**

Along with several other species, the dried leaves of this mint were smoked twice a day in Venda, South Africa, to treat certain mental illnesses (Arnold and Gulumian 1984). In Libya, oil extracted from the leaves was used to produce menthol cigarettes (Hussein 1985).

***Mentha arvensis* L. (Lamiaceae). wild mint.**

The smoke of this species was used in the tropics to repel mosquitoes (Lee et al. 2001). It has been used to flavor cigarettes in other parts of the world (Lewis and Elvin-Lewis 2003).

***Mentha pulegium* L. (Lamiaceae). pennyroyal.**

The smoke of burning pennyroyal leaves was used as an insecticide (McIndoo 1924).

***Mentha spicata* L. (Lamiaceae). spearmint.**

Known as *mnanaha* in East Africa, the leaves of this species were rolled into cigarettes and smoked to relieve asthma, tuberculosis, and other respiratory ailments (Heine and Legére 1995).

***Mentha* spp. (Lamiaceae). mints.**

The leaves of several species of mints were smoked by Native Americans as soothing agents (Kavasch 1979).

***Mentha sylvestris* L. ssp. *viridis* (Lamiaceae). horse mint.**

The smoke produced by burning the entire plant was used as a fumigant to treat oxytocic in the Ubage Valley of France (Novaretti and Lemordant 1990).

***Mentha viridis* (L.) L. (Lamiaceae). garden mint.**

In the Swahili-speaking areas of East Africa, the leaves of this species were smoked for the relief of tuberculosis, asthma, and other respiratory illnesses (Heine and Legére 1995).

***Mentzelia affinis* Greene (Loasaceae). yellowcomet.**

The Hopi of North America smoked parts of this plant when tobacco (*Nicotiana* spp.) was not available (Colton 1974).

***Mentzelia multiflora* (Nutt.) A. Gray var. *multiflora* (Loasaceae). Adonis blazingstar.**

The Kayenta Navajo of North America burned this plant for incense purposes during the collared lizard ceremony (Wyman and Harris 1951).

***Mentzelia pumila* Torr. & A. Gray. (Loasaceae). dwarf mentzelia.**

The Hopi of North America smoked this plant when tobacco (*Nicotiana* spp.) was unavailable (Whiting 1939).

Mentzelia multiflora

***Michelia champaca* L. (Magnoliaceae). golden champa.**

Tribal members of Nilgiris in India's southernmost state, Tamil Nadu, burned the dried flowers at night to repel mosquitoes (Rajendran and Aswal 2000). The local name for the species is *shebahapoo*.

***Micromeria biflora* Benth. (Lamiaceae). lemon scented thyme.**

In Nepal, the whole plant was considered useful for burning as incense (Manandhar 2002).

***Mikania sagittifera* B. L Rob. (Asteraceae). oruhona.**

This species was highly sought after by the women of the Herero-speaking peoples of Kaokoland, northwestern Namibia (Malan and Owen-Smith 1974). The runners

and the leaves, which grew on reeds only along the banks of the Kunene River, were burned in ovens to produce smoke that was considered ideal for perfuming clothes and bedding. The women went to great lengths to procure these plants.

***Millingtonia hortensis* L. f. (Bignoniaceae). cork tree.**

The Thai name for this plant is *peep*. The flowers were rolled into a cigarette and smoked for pleasure (Pongs-Boonrod 1950; Boonyarattanakornkit and Supawita 1977; Mueanwongyaat 1981).

***Mimosa pudica* L. (Mimosaceae). twelve o'clock.**

In the rain forests of Belize, people smoked dried leaves to alleviate muscle spasms, irritability, and backache (Arvigo and Balick 1993). The same smoke was used to remove toothworms from the mouths of the people of India's Mizoram State, where this species is known as *hlonuar* (Lalramnghiglova 2003). The leaves were smoked like cigarettes.

***Mirabilis nyctaginea* (Michx.) MacMill. (Nyctaginaceae). heartleaf four o'clock.**

The Western Keres of North America smoked the leaves as a tobacco (*Nicotiana* spp.) substitute (Swank 1932). This species was reported as its synonym, *Allionia nyctaginea* Michx., in original texts.

***Mitchella repens* L. (Rubiaceae). partridge berry.**

The Ojibwa of North America burned the leaves for incense purposes during ceremonies (Reagan 1928).

***Mitragyna ciliata* Aubrév. & Pellegr. (Rubiaceae). abura.**

Asita and Campbell (1990) reported that the wood of abura could be burned to produce smoke that effectively inhibited three species of bacteria—*Staphylococcus aureus, Saccharomyces cerevisiae,* and *Eschirichia coli*—all of which are known to spoil food.

Mitchella repens

***Mitragyna speciosa* Korth. (Rubiaceae). kartom.**

The effects of the dried leaves, when smoked, were said to be similar to the combined effects of cocaine and morphine (Schultes et al. 2001). The species was used in Southeast Asia, especially Thailand, where it was often used as an opium substitute. One of the main alkaloids discovered in the species, mitragynine, exhibits very little toxicity even in large doses.

***Mollugo pentaphylla* L. (Molluginaceae). Mollugo.**

This plant was smudged in the Solomon Islands to repel mosquitoes (Perry 1980).

***Momordica balsamina* L. (Cucurbitaceae). balsam apple.**

In Africa, syphilis and rheumatism were cured with smoke baths in which the roots of the balsam apple were roasted (Neuwinger 1994).

Mitragyna speciosa

***Momordica charantia* L. (Cucurbitaceae). balsam pear.**

Like *M. balsamina* L., syphilis and rheumatism were treated with the smoke of burning balsam pear roots (Neuwinger 1994).

***Monanthotaxis caffra* (Sond.) Verdc. (Annonaceae). dwaba berry.**

The Zulu tribes of South Africa smoked the roots to cure hysteria and bad dreams (Gerstner 1941).

***Monanthotaxis fornicata* (Baill.) Verdc. (Annonaceae). hairy mgweni.**

In the Tongoni village of the Tanga District of Tanzania, the outer root bark was burned and the resultant smoke inhaled to treat mental diseases (Hedburg et al. 1982).

***Morina coulteriana* Royle (Morinaceae). Morina.**

In the Ladakh region of northern India, the roots of this species were burned in the monasteries (gumpas) as incense (Shah 1982). The smoke was also prized for curing abscesses. In India's Lahoul Valley (northwestern Himalayas), the people of the Kinang tribe burned the flowers as incense (Sood et al. 2001).

***Morina longifolia* Wall. ex. DC. (Morinaceae). whorlflower.**

The entire plant was burned in Nepal for incense purposes (Manandhar 2002). It was also prized in the Ladakh region of northern India, where it was burned in the monasteries (Shah 1982).

***Mucuna pruriens* (L.) DC. (Fabaceae). cowhage.**

Smoke from burning fruits was inhaled in parts of India to relieve toothache pain (Williamson 2002).

***Mundulea sericea* (Willd.) A. Chev. (Fabaceae). fishbean.**

In Namibia, the leaves of this species were burned alone or in combination with the leaves of *Leucas pechuelii* Baker for the treatment of furunculosis. The species is known locally as *omukeka* (von Koenen 2001).

***Murraya koenigii* Spreng. (Rutaceae). curry leaf.**

The Swahili-speaking people of eastern Africa burned the leaves of this plant, known locally as *mvuje,* to keep devils away from sick children (Williams 1949).

***Musa acuminata* Colla (Musaceae). edible banana.**

During the 1960s, the charred inner scrapings of banana rinds were smoked in the United States and elsewhere in the belief that they induced an hallucinogenic effect. Bozzetti et al. (1967) reported that the effects were due solely to the psychic suggestibility of its users.

***Musa* x *paradisiacal* L. var. *paradisiacal* (Musaceae). plantain.**

In Nigeria, unspecified parts of this relative of the banana were often dried in the sun and then smoked for pleasure (Okiy 1960).

***Myoporum acuminatum* R. Br. (Myoporaceae). water bush.**

The Arrernte of Australia burned the branches of the water bush, also known as *western boobialla*, to produce smoke that was inhaled for general ailments (Latz 1995).

Myoporum acuminatum

***Myriactis nepalensis* Less. (Asteraceae). Nepalese myriactis.**

The leaves were dried and smoked for pleasure in India's Bhaderwah Hills (Kapur

and Nanda 1996) and Udhampur District (Jammu Province) (Kapur and Srivastava 1996).

***Myrica asplenifolia* L. (Myricaceae). sweet fern.**

The Potawatomi of North America burned the leaves of this species to generate smoke that kept mosquitoes away (Smith 1933). Moerman (1998) suggests that the species actually used may have been *Comptonia peregrina* (L.) Coult.

***Myrica gale* L. (Myricaceae). sweetgale.**

The Potawatomi of North America burned this species as a smoke smudge that repelled mosquitoes (Smith 1933).

***Myrica pensylvanica* Mirb. (Myricaceae). northern bayberry.**

The berries produce a thick, gluey substance, which, when mixed with beeswax, was used in North America to make candles that gave off a pleasant scent (Carver 1778).

***Myricaria germanica* (L.) Desv. ssp. *alopecuroides* (Schrenk.) Kitam (Tamaricaceae). false tamarisk.**

In India's Lahoul-Spiti areas of the northwestern Himalayas, the Jispa and Kaza tribes burned powdered leaves and flowers from this species as incense (Sood et al. 2001).

***Myristica fragrans* Houtt. (Myristicaceae). nutmeg.**

This species has been used to give flavor to cigars (Lewis and Elvin-Lewis 2003). It produces aromatic oils.

***Myristica* sp. (Myristicaceae). Myristica.**

The people of Java, Indonesia, burned the wood of a *Myristica* species to perfume their clothing (Uphof 1968).

***Myrothamnus flabellifolius* Welw. (Myrothamnaceae). resurrection plant.**

In South Africa, the Pedi of Transvaal State inhaled smoke generated by burning this plant to relieve chest pain (Watt and Breyer-Brandwijk 1962). In Namibia, the leaves were smoked together with tobacco (*Nicotiana* spp.) to treat bronchial conditions, and the branches and roots were burned on red-hot coals to give off smoke that was inhaled for the relief of chest pain and lung congestion (von Koenen 2001). In South Africa, the leaves were smoked to treat asthma (Watt and Breyer-Brandwijk 1962; Hutchings et al. 1996). The Topnaar of Namibia inhaled the smoke of burning leaves to relieve asthma and chest pains and to ease epilepsy (van den Eynden et al. 1992).

***Myroxylon balsamum* Harms. (Fabaceae). balsam of Peru.**

In the Amazon, an unspecified group of people burned powdered bark of balsam of Peru as incense (Soukup 1970). In the markets of La Paz and El Alto in Bolivia, its seeds were sold as a cure for earache. The smoke of burning seeds was blown into the affected ear (Macía et al. 2005).

Myroxylon balsamum

***Myroxylon peruiferum* L. f. (Fabaceae). Brazilian balsam.**

In Bolivia, highland settlers near the village of Muyupampa burned the fragrant resin obtained from this species and inhaled its smoke to treat susto ("fright illness"; Willian 1989).

***Myrtus communis* L. (Myrtaceae). myrtle.**

Italians living in the Monte Vesole and Ascea areas of the Cilento National Park in southern Italy burned the leaves and branches of this species in their bread ovens to give their bread a pleasant aroma (Scherrer et al. 2005). In ancient Egypt, the plant was used for unspecified fumigation purposes (Manniche 1989).

***Nardostachys grandiflora* DC. (Valerianaceae). spikenard.**

This species was used in Nepal, where the dried leaves were burned as incense (Manandhar 2002).

***Nardostachys jatamansi* (Jones) DC. (Valerianaceae). muskroot.**

According to the Ayurvedic system of India, parts of this plant were dried in the sun and then soaked with ghee before being smoked like a cigarette to relieve asthma (Mishra 2003). In the Sikkim Himalayas of India, the roots were burned as incense to drive away evil spirits (Pandey 1991). In the Manang District of Nepal, muskroot was highly esteemed as incense because it did not grow near human habitations and therefore was not contaminated in any way (Pohle 1990). Elsewhere, in the Kumoan area of India, the rhizome and root portion were burned for incense purposes (Shah 1982).

***Nauclea latifolia* Sm. (Rubiaceae). pin cushion tree.**

In the Democratic Republic of Congo (Zaire), children with respiratory diseases were encouraged to inhale the smoke of burning seeds, which were burned in a calabash (Disengomoka et al. 1983).

***Neea* sp. (Nyctaginaceae). saltwood.**

The Waimiri Atroari of Brazil burned the wood of an unspecified species of *Neea,* which they called *sasyma lepy,* to smoke their fish and meat (Milliken et al. 1992).

***Neocarya macrophylla* (Sabine) Prance ex F. White (Chysobalanaceae). gingerbread plum.**

In parts of Senegal, where the species is known as *ba,* branches of the gingerbread plum were burned, and the smoke was inhaled as a remedy for snakebite (Mohagheghzadeh et al. 2006).

***Nepeta cataria* L. (Lamiaceae). catnip.**

According to Krochmal and Krochmal (1973), Native Americans living in the Appalachians smoked the dried leaves and stalks of this species to relieve respiratory problems. The Shinnecock of Long Island, New York, smoked dried catnip leaves in a pipe to treat rheumatism (Carr and Westey 1945).

Nepeta cataria

***Nepeta leucophylla* Benth (Lamiaceae). catmint.**

In the Manang District of Nepal, people collected the flowers of this species, dried and crushed them, and then burned them in a receptacle. The smoke was used to fumigate and revive a fainted or unconscious person (Pohle 1990).

***Nerium indicum* Mill. (Apocynaceae). south-sea rose.**

The ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.) lists this species as one of several whose smoke, when burned as part of a concoction

with other plants (recipe 4 under *Asparagus racemosus* Willd.), was used in India to kill animals (Sensarma 1998).

***Nerium odorum* L. (Apocynaceae). sweet scented oleander.**

This is another species mentioned in the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.). When mixed with an unspecified species of crab, parts of an unspecified plant gourd, the chaff and grain of an unspecified plant, chaff from castor oil (*Ricinus communis*), unspecified parts of *Paspalum scrobiculatum,* and unspecified parts of *Butea monosperma,* it was used in parts of India to generate smoke that, reportedly, killed animals for as far as the wind carried it (Shamastry 1960).

***Nerium oleander* L. (Apocynaceae). oleander (figure 19).**

This and other related species of *Nerium* are known to produce poisonous cardiac glycosides similar to those found in the foxglove, *Digitalis purpurea* L. The smoke generated while burning oleanders is therefore hazardous and has been known to harm and kill people (Nelson 2000).

Figure 19. *Nerium oleander*. Many species of plants like this oleander produce toxic agents that are suspended in smoke when burned. This species synthesizes cardiac glycosides that can cause serious heart problems in high doses.

***Nicotiana alata* Link and Otto (Solanaceae). jasmine tobacco (figure 20).**

The leaves were smoked in South America for unspecified purposes (Lewis and Elvin-Lewis 2003).

***Nicotiana attenuata* Torr. ex S. Wats (Solanaceae). coyote's tobacco.**

This species was used extensively for a variety of purposes by several Native North and South American tribes. The following tribes smoked the leaves for pleasure or related purposes: Blackfoot (Johnston 1987), Coahuilla (Barrows 1900), Gosiute (Chamberlain 1911), Havasupai (Weber and Seaman 1985), Hopi (Castetter and Bell 1942), Kawaiisu (Zigmond 1981), Klamath (Coville 1897), Mewuk (Hart 1966), Ramah Navajo (Vestal 1952), Okanagan-Coville (Turner et al. 1980), Paiute (Mahar 1953), Papago (Castetter and Bell 1942), Tewa (Robbins et al. 1916), Thompson (Perry 1952), and Yavapai (Gifford 1936). It was smoked for ceremonial purposes, including for medicine ceremonies, by the White Mountain Apache (Reagan 1929), Hopi (Fewkes 1896), Ramah Navajo (Vestal 1952), Tewa (Robbins et al. 1916), and Zuñi (Stevenson 1909). The Ramah Navajo smoked the leaves wrapped in corn husks to treat nosebleeds and coughs and to help heal the wounds of castrated horses (Vestal 1952). The Paiute smoked the leaves for coughs and asthma (Train et al. 1941). They also smoked the leaves for tuberculosis (Train et al. 1941), a purpose for which the Shoshone also smoked the leaves.

Nicotiana attenuata

***Nicotiana bigelovii* S. Wats. (Solanaceae). Bigelow's tobacco.**

The Costanoan burned the complete plant and blew the smoke it produced into the ear to treat earache (Bocek 1984). This species was used for a variety of ceremonial

and medicinal purposes by several North and South American tribes. See *Nicotiana quadrivalvis* Pursh var. *bigelovii* (Torr.) DeWolf for a list. Moerman (1998) suggests that it was this variety of *N. quadrivalvis* that was probably used.

Figure 20. At least 15 of the 64 recognized *Nicotiana* species (tobacco plants) were smoked for various purposes, including pleasure, medicine, and to keep evil spirits away. The species shown here is a variety of *N. alata*.

***Nicotiana bigelovii* S. Wats. var. *exaltata* (Solanaceae). native tobacco.**

This species was used for a variety of purposes by several North and South American tribes for ceremonial and medicinal purposes. See *Nicotiana quadrivalvis* Pursh var. *bigelovii* (Torr.) DeWolf for a list. Moerman (1998) suggests that *N. quadrivalvis* var. *bigelovii* was probably the species actually used.

***Nicotiana clevelandii* A. Gray (Solanaceae). Cleveland's tobacco.**

The Seri of Mexico smoked the leaves in pipes made of clay or from pipes fashioned from reed grass (Felger and Moser 1985). They smoked this species when *N. trigonophylla* Dunal. was unavailable. The leaves were smoked by the Cahuilla of southern California during hunting ceremonies (Bean and Saubel 1972). They also blew the smoke into the ears of sufferers of earache. Smoke from burning leaves was said to offer people protection during their travels.

***Nicotiana glauca* Graham (Solanaceae). tree tobacco.**

Native Americans blew the smoke generated by burning the leaves of this species into the ears of those suffering from earache (Foster and Hobbs 2002). The leaves were smoked by the Cahuilla of southern California during hunting ceremonies (Bean and Saubel 1972). They also blew the smoke into the ears of sufferers of earache. Smoke from burning leaves was said to offer people protection during their travels. Hawaiians used smoke to treat cuts (Akana 1922).

***Nicotiana multivalvis* Lindl. (Solanaceae). Indian tobacco.**

This species was smoked for unspecified purposes by the following Native American tribes: Mandan, Pawnee, Hocak (Winnebago), Crow, Gros Ventre, Northern Paiute, Pomo, and Yokuts (Seig 1999).

***Nicotiana plumbaginifolia* Viv. (Solanaceae). Tex-Mex tobacco.**

The Neeshenam of North America smoked sun-dried leaves for pleasure (Powers 1874). This species was also smoked for pleasure in the Sikkim Himalaya area of India (Pandey 1991).

***Nicotiana quadrivalvis* Pursh (Solanaceae). Indian bigelovii tobacco.**

The Blackfoot of North America regarded this species very highly and used it in a number of their ceremonies (Hellson 1974). The Dakota, Pawnee, Ponca, Hocak (Gilmore 1919), and Omaha (Gilmore 1913b), all of North America, smoked the plant for pleasure.

***Nicotiana quadrivalvis* Pursh var. *bigelovii* (Torr.) DeWolf (Solanaceae). Bigelow's tobacco.**

Native North Americans blew smoke that they produced by burning this plant to treat earache (Foster and Hobbs 2002). This species was used by a number of

different tribes in North and South America for a variety of purposes. These include being smoked for ritual and ceremonial purposes by the Costanoan (Bocek 1984). Moerman (1998) reports that the species actually used may have been *N. bigelovii* (Torr.) S. Wats. The Kawaiisu of California burned the leaves with lime for protection against evil spirits (Zigmond 1981). Moerman (1998) reports that the species used may have been *N. bigelovii* (Torr.) S. Wats. var. *exaltata*. The Mendocino of California smoked the plant for pleasure (Chestnut 1902), as did the Mewuks and the Midoos of California (Hart 1966), the Kashaya Pomo of northern California (Goodrich et al. 1980), and Tolowa of California (Baker 1981). Moerman (1998) suggests that the actual species used for these latter five tribes may have been *N. bigelovii* (Torr.) S. Wats.

***Nicotiana rustica* L. (Solanaceae). wild tobacco.**

One of the more popular tobacco species in the Americas was *N. rustica*. This species is thought to have originated in South America and later spread into North America. It was so popular that it was once cultivated almost everywhere in the Americas. To improve the size of future crops, some Native American tribes may have burned their tobacco fields at the end of each harvest. It is tempting to speculate that the combined effects of the heat and smoke generated in those fires may have acted as cues to the germination of more seeds than may have occurred naturally. This has already been demonstrated for *N. attenuata* Torr. ex S. Wats (Preston and Baldwin 1999). According to many Native Americans, one of the major drawbacks of smoking *N. rustica* was that it produced harsh smoke. It was therefore often mixed with several other species to dilute or flavor it. The Native American Algonquin word for these mixtures and blends was *kinnikinnick*, which should not be mistaken for the bearberry plant, *Arctostaphylos uva-ursi* (L.) Spreng., which was also smoked. Tobacco smoke was not, however, always diluted. The Chippewa reportedly smoked the leaves undiluted to deliberately induce a state of intoxication during certain ceremonies (Reagan 1928). The leaves of *Lobelia inflata* L. were smoked by Native North Americans to help them quit smoking tobacco (Tierra 1983). This species was cultivated and sold by some tribes. The Tarahumara of Mexico considered *N. rustica* an important element of many night ceremonies (Lumholtz 1902). They often smoked the leaves along with *Tagetes lucida* Cav. to produce a narcotic effect (Siegel et al. 1977). It was smoked for pleasure by the Apalachee (Hamel and Chiltoskey 1975), who also smoked it as part of a preballgame ritual (Hann 1986). The Iroquois (Rousseau 1945) and Pima (Castetter and Bell 1942) of North America smoked the species for pleasure. The former also used the smoke to predict future rain (Waugh 1916). This species was considered a sacred herb by the Huichol of the Jalisco and Nayarit States of Mexico. It was often smoked by their shamans (Bauml 1994).

Nicotiana rustica

***Nicotiana* spp. (Solanaceae). tobacco.**

At least 15 species of tobacco were smoked for various purposes by the people of the Americas, where its use was first reported. North American shamans used tobacco smoke to drive diseases out of the bodies of their patients (Seig 1999).

The leaves were often rolled into cigars for this purpose (Cooper 1949). Other tribes blew tobacco smoke down the throat of the bears they had killed (Brooks 1952). This was said to placate their ghosts. Other uses for tobacco include emetics, poultices, incense, and a variety of recreational and ceremonial purposes. Native Americans also smoked the leaves as a calmative (Kavasch 1979). To the north, the branch of the Iroquois that lived in Montreal, Canada, smoked the leaves to ensure good health (Brooks 1938). To the south, shamans, or *curanderos*, of the Valley of Puebla in Mexico added the fly agaric mushroom (*Amanita muscaria* [L. ex Fr.] Pers [Amanitaceae]) to tobacco and smoked the mixture to perform ritual medicinal diagnoses (Díaz 1979). In Brazil, the Tapirape smoked the leaves for muscle ache (Wagley 1943). Smoking the leaves was considered ideal for helping Haitians speak with their gods to help cure their sick (Brooks 1938). The smoke of tobacco was used as an insect repellent for a variety of pests (see Grainge and Ahmed 1988 for a review).

***Nicotiana tabacum* L. (Solanaceae). cultivated tobacco.**

Nicotiana tabacum

This species of tobacco is one of the most widely smoked plants on earth. Although it is predominantly smoked for pleasure, or addiction, it has a number of medicinal and ritual uses, many of which date back thousands of years. So important was this plant that it was cultivated by Native Americans and formed an important bartering agent. Few plants were more important to them, especially in South America (Schultes and Raffauf 1992). In the Amazon area, several tribes blew tobacco smoke over sick people either as a treatment or prelude to other treatments. In the Caribbean island of Montserrat, the leaves were smoked for their antispasmodic and sedative properties (Brussell 1997). In the rural parts of Honduras, midwives passed all newborn babies through the smoke of tobacco leaves (Ticktin and Dalle 2005). This gave them strength and protected them from illness. It was used for the same purposes by midwives in the commonwealth island of Dominica (Hodge and Taylor 1957). The smoke may have served as a pediatric medicine in Detroit, Michigan, where urban African American communities used it as a remedy for colic (Smitherman et al. 2005). Also in North America, the Cherokee smoked it for pleasure and as a remedy for toothache (Hamel and Chiltoskey 1975). Hawaiians blew smoke over cuts and sores (Akana 1922), and the Mohegan used it for earaches, as did the Rappanhoek and Shinnecock (Carr and Westey 1945). It was smoked or used for various other medicinal and ceremonial purposes by the Haisla-Hanaksiala (Compton 1993), Hequiats (Turner and Efrat 1982), Iroquois (Rousseau 1945), Navajo (Elmore 1944), Oweekeno (Cook 1930), Papago (Castetter and Underhill 1935), and Pima (Castetter and Bell 1942).

The plant was considered an excellent agent for driving away evil. According to Huastac Mayan mythology, tobacco was once used to trap and injure an evil being (Alcorn 1984). In northeastern Peru, shamans used tobacco to draw illnesses out of their patients and to protect them against evil people and

bad spirits (Luna 1984). In parts of the Amazon, tobacco was smoked during witchcraft, healing, and cleansing rituals (Duke and Vasquez 1994). The Shuar of eastern Ecuador smoked tobacco when they had bad visions of the devil (Bennett et al. 2002). Elsewhere in eastern Ecuador, tobacco was an important aspect of many Quichua and Secoya-Siona rituals to ward off evil (Vickers and Plowman 1984). The Quichua and Secoya-Siona shamans "cleaned" their patients with the smoke of tobacco (Vickers and Plowman 1984). The shaman blew tobacco smoke over patients in whom parasitic larvae had burrowed into the skin. The smoke reportedly killed the parasites. The Mapuche of south-central Chile smoked the leaves to induce an ecstatic or stupefied state (Houghton and Manby 1985). In Colombia, the leaves were heated until they were soft. They were then pounded with a mortar and shaped into round cakes, and then they were dried in front of a fire. The tobacco cakes were rolled up in "wild banana" leaves and were smoked in cigars for pleasure (Schultes 1985b). The Huastac Maya smoked the leaves of tobacco for recreation as well as to scare away snakes and during a variety of rituals and offerings (Alcorn 1984). In the Andes, many peasants smoked tobacco because they believed it warmed them (Bastien 1987).

With the spread of tobacco to the rest of the world, it rapidly found use for medicinal and other purposes. In Hungary, where the name for tobacco is *dohány,* the leaves were smoked to relieve toothache and earache (Antalné Tanko 2003). The leaves were smoked for the relief of asthma and nervous excitement in Rewalsar, India (Sood and Thakur 2004). It was smoked for pleasure by the Wola of the highlands of Papua New Guinea (Sillitoe 1983). The leaves were smoked for cultural purposes in Papua New Guinea by Nakopo villagers in the Madang and Morobe Provinces (Schmid 1991).

***Nicotiana thyrsiflora* Goodsp. (Solanaceae). tobacco.**

In parts of Peru, the leaves were smoked for pleasure (von Reis and Lipp 1982).

***Nicotiana tomentosa* Ruiz and Pav. (Solanaceae). tobacco.**

It was believed in Peru that smoking the leaves of this species gave the smoker a headache (von Reis and Lipp 1982).

***Nicotiana trigonophylla* Dunal. (Solanaceae). desert tobacco.**

The Cahuilla of California used the smoke as a remedy for earache (Bean and Saubel 1972). They also smoked the plant for several ceremonial and recreational purposes and believed that the smoke could offer them protection during their travels (Bean and Saubel 1972). Other Native American tribes, including the Havasupai (Spier 1928), Hopi (Whiting 1939), Hualapai (Watahomigie 1982), Mohave (Castetter and Bell 1951), Papago (Castetter and Underhill 1935), Pima (Castetter and Bell 1937), and Yuma (Castetter and Bell 1951), smoked the plant for ceremonial purposes or for pleasure. Desert tobacco was smoked for a variety of unspecified purposes by the Zuñi and Papago tribes of North America (Seig 1999).

***Nigella sativa* L. (Ranunculaceae). black cumin.**

According to Avicenna, the fumes of burning leaves were used in Iran as pest repellents (Mohagheghzadeh et al. 2006).

***Notholaena eckloniana* Kuntze (Adiantaceae). cloak fern.**

The leaves were smoked in India to relieve both chest and head colds (Singh, H. B., 2000).

***Obetia pinnatifida* Baker (Urticaceae). stinging nettle tree.**

Unspecified parts of this plant were burned by the Rendille of northern Kenya to fumigate and cleanse their containers (Heine and Heine 1988b).

***Ochna pulchra* Hook. (Ochnaceae). peeling bark ochna.**

In Namibia, the inner bark of the species was thrown on glowing embers to produce smoke that drove away the evil entities that occurred during bad dreams (von Koenen 2001).

***Ocimum americanum* Mill. (Lamiaceae). American basil.**

In Swahili-speaking areas of East Africa, the entire plant was burned inside huts at night to keep mosquitoes away (Greenway 1937). The Swahili name for the plant is *kinuka*. In Tanzania, the smoke was used to repel insects and to treat sore eyes (von Reis and Lipp 1982).

***Ocimum basilicum* L. (Lamiaceae). common basil.**

Known locally as *chesekom,* the Pokot of northern Kenya often burned common basil for its aromatic smoke (Timberlake 1987).

***Ocimum canum* Sims (Lamiaceae). hoary basil.**

In the rural villages of the Oio region of Guinea-Bissau, West Africa, villagers burned the whole plant, when collected fresh, to generate smoke that drove away mosquitoes (Pålsson and Jaenson 1999b). The Okavango of Africa burned the plant because they believed that the smoke could clear bad smells and excoriate, or abrade, babies' bottoms (von Koenen 2001). The Sotho of South Africa claimed that the smoke stopped nosebleeds, and in Zimbabwe, it was used to stop convulsions (van den Eynden et al. 1992).

***Ocimum kilimandscharicum* Gürke (Lamiaceae). camphor basil.**

The smoke from burning leaves was reported to repel mosquitoes in western Kenya (Seyoum et al. 2003).

***Ocimum lamiifolium* Hochst. (Lamiaceae). Kakuba nsili.**

Leaves were smoked by people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Ocimum sanctum* L. (Lamiaceae). holy basil.**

Smoke from the whole plant was used as a fumigant to treat fever and sunstroke in parts of Indo-China (Foucard 1954). An oil extract of the seed husks was burned to repel mosquitoes in Sri Lanka (Silva 1991), and other parts of the plant were burned to repel and kill a variety of agricultural pests (see Grainge and Ahmed 1988 for a review).

***Ocimum* spp. (Lamiaceae). basils.**

Known in Tanzania as *kivumbas*i, freshly collected basil plants were burned to repel mosquitoes (Stephens et al. 1995).

Ocimum kilimandscharicum

***Ocimum suave* Willd. (Lamiaceae). basil.**

The leaves of this species, when burned, were reported to be useful in repelling mosquitoes in western Kenya (Seyoum et al. 2003). In Uganda, the So burned the entire plant and used its smoke to perfume their bodies and clothes (Heine and König 1988b).

***Ocimum viride* Willd. (Lamiaceae) mosquito plant.**

The leaves of this plant, as the common name suggests, were burned to generate smoke that was considered ideal for repelling mosquitoes (McIndoo 1945).

***Ocotea bullata* E. Mey. ex. Meisn. (Lauraceae). black stinkwood.**

The Zulu of South Africa burned the bark and inhaled the smoke to relieve headaches (Watt and Breyer-Brandwijk 1962; Hutchings and van Staden 1994; Hutchings et al. 1996).

***Oenothera albicaulis* Pursh (Onagraceae). whitest evening primrose.**

The Hopi of North America smoked parts of this species for pleasure while using an unspecified related species to ward off the common cold (Dunmire and Tierney 1997).

***Oenothera cespitosa* ssp. *marginata* (Nutt. ex Hook. & Arn.) Munz. (Onagraceae). tufted evening primrose.**

The Hopi of North America smoked this plant as a substitute for tobacco (*Nicotiana* spp.) (Colton 1974). The Ramah Navajo, also of North America, mixed dried leaves with their tobacco to add flavor to it (Vestal 1952).

***Oenothera villosa* ssp. *strigosa* (Rybd.) W. Dietr. & Raven. (Onagraceae). hairy evening primrose.**

The Ramah Navajo of North America mixed dried leaves to tobacco (*Nicotiana* spp.) to bring them good luck during hunting (Vestal 1952). This species was reported as *O. procera* Wooton & Standl. in the original texts.

***Olea africana* Mill (Oleaceae). African olive.**

The Chamus (Heine and Heine 1988a), Rendille (Heine and Heine 1988b), and Gabbra (Heine and Brenzinger 1988) of Kenya burned the sticks of this species to fumigate and cleanse their containers (Heine and Heine 1988a). This was also a common practice of the Borana of Ethiopia (Heine and Brenzinger 1988).

***Olea europea* L. (Oleaceae). olive.**

The Borana of Ethiopia and the Gabbra of Kenya burned the dry branches of olive trees to fumigate and cleanse their containers (Heine and Brenzinger 1988).

***Olea europea* L. ssp *africana* (Mill). P. Green. (Oleaceae). wild olive.**

The Loita Maasai of Narok District, Kenya, burned the leaves of the wild olive, which was used in many ceremonies, to emit smoke that was used to bless the village as well as young boys when they were circumcised (Maundu et al. 2001). This species is referred to locally as *olasar*. The Chamus, also of Kenya, burned the plant to fumigate and cleanse their gourds (Heine and Heine 1988a).

***Onoseris albicans* (D. Don.) Ferreyra (Astercaeae). Onoseris.**

The Chinchero, a small Andean community of southern Peru, burned unspecified parts of this plant inside sheep corrals because the smoke was believed to prevent their sheep from running away (Franquemont et al. 1990).

***Onosmodium thurberi* A. Gray. (Boraginaceae). giant trumpets.**

The Hopi of North America used the smoke of burning giant trumpets to treat insane people (Whiting 1939). Moerman (1998) suggests that the species actually used may have been its synonym, *Macromeria viridiflora* DC.

***Oplismenus compositus* (L.) P. Beauv. (Poaceae). running mountaingrass.**

On the Nicobar Islands of India, green plants were added to fire to produce smoke that was used as a fumigant to relieve the pain of snakebites (Dagar and Dagar 1999).

***Oplopanax horridus* Miq. (Araliaceae). devil's club.**

The Crow of North America mixed the roots with tobacco (*Nicotiana* spp.) to treat headache (Blankinship 1905). The species reported in the original texts

was *Fatsia horrida* Benth & Hook. f. In British Columbia, Canada, the smoke of burning plants was used traditionally to drive away disease-causing spirits (Turner 1998).

***Orbignya martiana* Barb. Rodr. (Aracaceae). babassu palm.**

In parts of South America, the smoke of unspecified parts of this plant, when burned, was used to coagulate rubber (Usher 1974).

***Origanum heracleoticum* L. (Lamiaceae). Greek oregano.**

In the mountainous area of southern Italy's Central Lucania, smoke from burning flowers was inhaled to relieve the pain of toothache (Pieroni et al. 2004).

***Origanum vulgare* L. (Lamiaceae). oregano.**

In Nepal, the dried leaves were burned to produce fragrant smoke (Manandhar 2002).

***Ormocarpum trichocarpum* (Taub.) Harms (Fabaceae). Osmocarpum.**

This species, when burned, produced smoke that was used by the Samburu of Kenya to fumigate and cleanse their containers and to drive bees away from their hives so that their honey could be collected (Heine and König 1988a).

***Oryza sativa* L. (Poaceae). rice.**

The Lahu villagers of northern Thailand burned unspecified parts of the rice plant for smoke that kept evil spirits away (Anderson 1993).

***Osmorhiza occidentalis* Torr. (Apiaceae). sweet cicely.**

In the western parts of North America, the smoke of burning roots was inhaled to treat colds (Usher 1974).

***Osmoxylon umbelliferum* Merr. (Araliaceae). Osmoxylon.**

The reddish scented wood of this species was burned in Indonesia as incense (Uphof 1968; Usher 1974).

***Osteophloeum platyspermum* (Spruce ex DC.) Warb. (Myristicaceae). ucuuba-amarela.**

Laborers of Reserva Ducke in the Amazon inhaled the smoke of burning leaves to relieve asthma (Schultes and Raffauf 1990). *Ucuuba-amarela* is a common name used in Portugal.

***Osyris abyssinica* Hochst. & A. Rich. (Santalaceae). Transvaal sumach.**

The Samburu of Kenya used smoke from smoldering wood to treat swollen breasts in women. The smoke was passed over the breasts while goat's fat was rubbed on them (Heine and König 1988a).

***Osyris compressa* DC. (Santalaceae). coastal sumach.**

This species was used for the same purposes as *O. abyssinica* Hochst. & A. Rich. (Heine and König 1988a).

***Osyris lanceolata* Hochst. & Steudal (Santalaceae). mpeta.**

In Venda, South Africa, the roots, when burned, produce smoke that was used to treat menorrhagia. Affected women exposed their vulva to the smoke (Arnold and Gulumian 1984).

***Osyris quadripartita* Salzm. ex Decne. (Santalaceae). rock tannin bush.**

Smoke generated in saunalike chambers was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms. The branches of this root hemiparasite were also routinely burned by the Shuhi of southwest China as incense (Weckerle et al. 2006).

***Otholobium polystictum* (Benth. ex Harv.) C. H. Stirt. (Fabaceae). hookleaf pea.**

The Sotho of South Africa smoked the roots as a cold remedy (Watt and Breyer-Brandwijk 1962).

***Otostegia integrifolia* (R. Br.) Benth. (Lamiaceae). tinjute.**

This species was used by the highlander tribes of Ethiopia, where the branches and leaves were smoked for the ritual cleansing of postpartum mothers (Wilson and Mariam 1979). It is known in Ethiopia as *tinjute*. Its smoke was also used to flavor and sterilize utensils and to treat clothes (Getahun 1976).

***Ozoroa reticulata* (Baker f.) R. Fern & A. Fern (Anacardiaceae). currant resin tree.**

The roots of this species were used in conjunction with others to treat tuberculosis in northern and eastern Mozambique (Verzár and Petri 1987). The patient dried the plant parts and placed the mixture on glowing coals. The patient was then covered with a blanket and made to inhale the smoke. The other species in the mixture were *Aspilia mossambicensis* (Oliv.) Willd., *Clematopsis scabiosifolia* Hutch., *Clerodendron discolor* Becc., and *Helichrysum kirkii* Oliv. & Hiern.

***Ozoroa schinzii* (Engl.) R. Fern. and A. Fern. (Anacardiaceae). Ozoroa.**

In Namibia, the roots of this species were thrown on glowing embers to produce smoke that fumigated swollen or painful parts of the body (von Koenen 2001).

***Paeonia officinalis* L. (Paeoniaceae). common peony.**

In Iran, the fruit of the common peony was burned to produce smoke that was thought to possess anticonvulsive properties according to Avicenna (Mohagheghzadeh et al. 2006).

***Palisota ambigua* C. B. Clarke (Commelinaceae). Palisota.**

In the Democratic Republic of Congo (Zaire), children suffering from asthma were made to inhale the smoke of burning seeds (Disengomoka et al. 1983). As part of the treatment, members of the family were expected to dance to the sound of a wooden bell.

***Palisota hirsuta* K. Schum. ex C. B. Clarke (Commelinaceae). yoruba.**

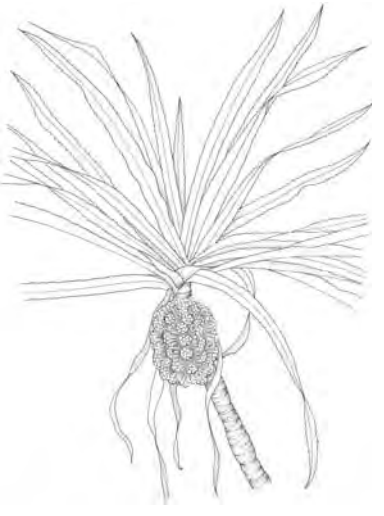
The smoke of burning dried leaves was inhaled in West Africa for toothache (Dalziel 1948). In Nigeria, the leaves were smoked to treat headaches (Neuwinger 1994).

***Panax quinquefolius* L. (Araliaceae). American ginseng.**

The Iroquois of North America smoked dried roots for every ailment (panacea) and for reviving fainted people (Herrick 1977).

***Pandanus fascicularis* Lam. (Pandanaceae). kewda.**

The male spadices were important sources of perfumery products in India (Dutta et al. 1987). Known locally as *kewda,* these products were mostly used for making soaps, bouquets, lotions, and hair oils. They were also used in the preparation of incense sticks (agarbatties), for scenting clothes, and for flavoring both betel (*Pan masala*)



Pandanus fascicularis

and food. Its most important use was, however, to flavor tobacco (*Nicotiana* sp.). The majority of India's production of kewda occurred in the Ganjam District of Orissa State and is thought to be a practice that is more than 200 years old.

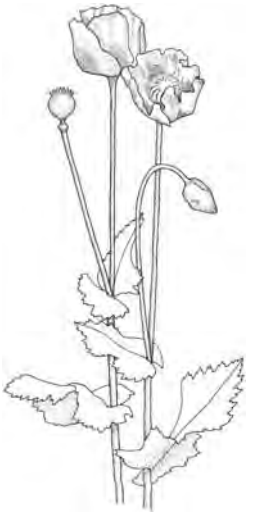
***Pandanus leram* Jones ex Voigt (Pandanaceae). Nicobar breadfruit.**

The leaves were smoked for pleasure on the Nicobar Islands of India (Dagar and Dagar 1999).

***Panicum antidotale* Retz. (Poaceae). blue panic grass.**

The whole plant was burned for smoke that was considered useful for disinfecting smallpox-induced wounds in India (Chopra et al. 1956) and in Sri Lanka (Jayaweera 1981b).

***Papaver somniferum* L. (Papaveraceae). opium poppy.**



Papaver somniferum

Opium latex tapped from unripened seedpods was harvested and smoked all over the world for its narcotic effects (Booth 1996) (see Introduction). The milky sap is usually collected 2 weeks after the petals have dropped. Experienced opium farmers know that the pods are ready once the points of the crown are erect and curving upward. Steel or glass blades are used to cut an incision 1 to 1.5 mm deep into the pods. The white sap that exudes from the pods oxidizes on contact with the air and changes color. The dark brown sticky substance that remains is scraped off and collected. It is later dried in the sun to remove most of the water. The paste is further dried on shelves wrapped in various materials. It can remain in the hardened state for extended periods. Its value increases as more water is evaporated from the mass. Opium has to be cooked and processed before it can be smoked. During the cooking process, the raw material is boiled in water, where it rapidly dissolves. Impurities or unwanted additions float to the surface or sink to the bottom. The liquid is usually filtered and then boiled again. After the second boiling, it is left to simmer until a thick, brown paste remains. It is then molded and dried in the sun again until it hardens. At that point, it is ready for use. In northern Thailand, the Akha smoked the dried latex from the plant for its analgesic properties (Anderson 1986).

***Pappea capensis* Eckl. & Zeyh. (Sapindaceae). jacket plum.**

The Borana of Ethiopia and the Gabbra of Kenya burned this species as incense (Heine and Brenzinger 1988).

***Parastrephia lepidophylla* (Wedd.) Cab. (Asteraceae). tola tola.**

In northwestern Argentina's Zenta River Basin, dried, crumpled tola tola plants were burned on hot coals to produce smoke that was used externally to speed up childbirth (Hilgert 2001). The smoke was fanned toward the inner thigh and lumbar regions of the body.

***Parina* sp. (Poaceae). ku-mu.**

Smoke produced by burning an unspecified species of *Parina* was considered useful in Suriname for the relief of pain (Defilipps et al. 2004).

***Parinari curatellifolia* Planch. ex Benth. (Chrysobalanaceae). mabola plum.**

The roots of this species, along with those of other species, were used in Namibia to treat angina pectoris and other heart conditions (see *Annona stenophylla* Engl. & Diels.; von Koenen 2001).

***Parkia biglobosa* (Jacq.) R. Br. ex G. Don. (Fabaceae). Africa locust bean.**

In the rural villages of the Oio region of Guinea-Bissau, West Africa, people burned the seed capsules of this species to generate smoke that was used to drive away mosquitoes (Pålsson and Jaenson 1999b).

***Paspalum scrobiculatum* L. (Poaceae). ricegrass paspalum.**

This species was a key ingredient in a concoction of plants and animals that, when burned to produce smoke, was reported to cause blindness in one's enemies (Sensarma 1998). This was according to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.). Included in the mixture were parts of an unidentified reed as well as unspecified parts of *Asparagus racemosus* Willd., *Butea monosperma* (Lam.) Taub. in Engl. & Prantl, *Ricinus communis* L., *Saussurea lappa* (Decne.) C. B. Clarke, *Stehania hernandiflora* Walp., and *Tragia involucrata* L. This species was also part of another mixture used to kill animals (see recipe 4 under *Asparagus racemosus* Willd.). See also *Nerium odorum*.

***Passiflora incarnata* L. (Passifloraceae). purple passionflower.**

The leaves and flowers were dried, crushed, and then smoked as a sedative (Ross 2002).

Passiflora incarnata

***Pavonia zeylanica* (L.) Cav. (Malvaceae). chitta mutti.**

The Gabbra of Kenya's Marsabit District burned this species and used it as a fumigant to treat bewitched cows that gave blood instead of milk (Stiles and Kassam 1986).

***Pechuel-loeschea leubnitziae* O. Hoffm. (Asteraceae). stinkbush.**

The Kwanyama of Namibia inhaled smoke arising from smoldering stinkbush to treat colds (von Koenen 2001).

***Peganum harmala* L. (Zygophyllaceae). African rue.**

The leaves of this species were burned as incense in the Ladakh region of India (Bhattacharyya 1991). The seeds were smoked in the Indus Valley of India's Ladakh region to induce a feeling of exaltation (Singh et al. 1996). In Punjab, India, the smoke of seeds was used to purify areas where weddings took place. In the state of Rajasthan, India, smoke from burning seeds and leaves was used as an antiseptic fumigant for wounds (Shah 1982). In both India and Pakistan, smoke from the seeds was used as a house disinfectant after babies were born (Hassan 1967). In central Asia, the seeds were burned as a traditional intoxicant and as a sexual stimulant (van Wyk and Wink 2004). In Iran and Iraq, the seeds were thrown on burning coals during wedding ceremonies. The smoke was believed to drive away the evil eye and keep epidemics at bay (Hooper and Field 1937). In Uzbekistan, the seeds were burned on hot embers to produce smoke that was inhaled to treat colds. The entire herb was sometimes burned as incense for colds (Sezik et al. 2004). In Sinai and the Negev, Bedouins smoked the seeds (with goat fat) to relieve aches in joints, limbs, and the back (Bailey and Danin 1981). The smoke from the leaves was used to keep mosquitoes away in Kanabad village and allied

Peganum harmala

areas of the Gilgit District of Pakistan (Gorsi and Miraj 2002). Secoy and Smith (1983) reported that the smoke of burning roots carries with it an alkaloid that is toxic to lice and mosquitoes. In Balochistan, Pakistan, the seeds were routinely burned over hot coals to generate smoke that was said to exorcize evil spirits from people (Burkill 1909; Goodman and Ghafoor 1992). The smoke was also used to cure infertility in women. The smoke, which was introduced into the vagina by a special pipe, was believed to kill the germs that attack sperm. Abdominal pains in pregnant women were also treated by this method. Blatter et al. (1919) reported that the smoke was inhaled for any sickness.

***Peganum harmala* L. var. *stenophyllum* Boiss. (Zygophyllaceae). harmala.**

Members of the Garisia tribe in India's Rajasthan State inhaled the smoke produced by burning dry plants for the relief of toothache (Singh and Pandey 1998).

***Pellaea calomelanos* Link (Adiantaceae). hard fern.**

The fronds of this fern were smoked in India for the relief of asthma and colds (Singh G. S. 2000). The Xhosa and Sotho of South Africa smoked the leaves for asthma and head colds (Watt and Breyer-Brandwijk 1962; Hutchings and van Staden 1994; Hutchings et al. 1996). The Zulu, also of South Africa, inhaled the smoke of burning leaves for the relief of headaches (Roberts 1990).

***Pentaclethra macrophylla* Benth. (Fabaceae). oilbean tree.**

Smoke from burning branches was considered useful in Nigeria for treating mood swings (Oliver-bever 1983).

***Peperomia emarginella* C. DC. (Piperaceae). Guadeloupe peperomia.**

In Trinidad, West Indies (Wong 1976), and in the Lesser and Greater Antilles (Stehlé 1962), the smoke produced by burning whole plants was inhaled to relieve asthma.

***Perideridia gairdneri* (Hook. and Arn.) Mathias. (Apiaceae). Gairdner's yampah.**

The Blackfoot of North America smudged the roots for relief from bad coughs (Hellson 1974).

***Persea americana* P. Mill. (Lauraceae). avocado.**

In Oaxaca, Mexico, the smoke of burning leaves was inhaled for treating wounds and bruises (Browner 1985). The leaves were burned under the cradles of Pueblan children as a remedy for fright (Martinez Alfaro 1984).

***Persea borbonia* Spreng. (Lauraceae). red bay.**

The Seminole of North America burned the leaves to generate smoke that was inhaled by babies to treat diarrhea (Sturtevant 1955).

***Petalidium* sp. (Acanthaceae). Petalidium.**

A variety of species of this genus were considered useful to the Kuanyama Ango of Angola. They used smoke generated by burning strips of palm leaf to treat aching legs (Loeb et al. 1956).

***Peteria scoparia* A. Gray. (Fabaceae). rush peteria.**

The Ramah Navajo of North America burned the dried tops of this plant for veterinary purposes (Vestal 1952). Shepherds forced their sheep to inhale the smoke for unspecified purposes.

***Petiveria alliacea* L. (Phytolaccaceae). guinea henweed.**

Known in Guatemala as *apacín* and *amurru,* the leaves of the guinea henweed were burned for smoke that was reported to have insecticidal properties (Gíron et al. 1991).

***Petunia violacea* Lindl. (Solanaceae). shanin petunia.**

The natives of Ecuador smoked the dried herb to induce visions of flight (Schultes et al. 2001).

***Peucedanum officinale* L. (Apiaceae). hog's fennel.**

This was one of the species that ancient Egyptians burned for smoke that kept insects away from their houses (Manniche 1989). This species was also used for incense purposes according to the Bible (Exodus 30:34; Manniche 1989).

***Peucedanum* sp. (Apiaceae). silver wort.**

According to ancient Egyptian texts, parts of a species of *Peucedanum* were thrown into fires inside their houses because the smoke was believed to drive away insects (Manniche 1989). This species was also used for incense purposes according to the Bible (Exodus 30:34; Manniche 1989).

***Pharus latifolius* L. (Poaceae). broad stalkgrass.**

The smoke generated by burning the whole plant was inhaled for its sedative properties in Suriname (Defilipps et al. 2004).

***Philonoptera violacea* (Klutzsch) Schrire. (Fabaceae). apple leaf.**

In South Africa, the smoke produced by burning wood of this species was believed to produce disharmony in families and so was avoided (Shackleton et al. 2005).

***Philoxerus vermicularis* (L.) P. Beauv. (Amaranthaceae). silverhead.**

In parts of Oceania, this plant was burned to smoke fish, giving it color and flavor (Banadaranayake 1998).

***Phlomis purpurea* L. ssp. *almeriensis* (Pau) Losa and Rivas Goday ex Rivas Mart. (Lamiaceae). Phlomis.**

The leaves were dried and then smoked for recreational purposes by the people of Almería, Spain (Martínez-Lirola et al. 1996).

***Phoenix dactylifera* L. (Arecaceae). date palm.**

In India, the fruit was burned so that the smoke it produced could be directed over the skin for general dermatological complaints (Caius 1998).

***Phragmanthera usuiensis* (Oliv.) M. Gilbert (Loranthaceae). Mugulukila gwo muvule.**

The complete plant was smoked by the people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Phyllanthus maderaspatensis* L. (Euphorbiaceae). canoe weed.**

The smoke generated by burning this plant was used in Kenya to keep caterpillars away from maize cobs (Burkill 1994).

***Physalis minima* L. (Solanaceae). pygmy groundcherry.**

The Nepalese of Assam rolled dried fruits into cigars and smoked them for the relief of headaches (Sharma, U. K. 2000). The local name for the plant is *jangali phakphakay*.

***Physalis pubescens* L. (Solanaceae). husk tomato.**

When the wood of this species was burned, it reportedly generated smoke that was considered ideal for treating skin diseases by the people of Guyana (Defilipps et al. 2004).

***Physochlaina praealta* Miers (Solanaceae). dhandhura.**

In the Lahoul Valley of India, smoke from burning seeds was used as a fumigant for the relief of toothache (Sood et al. 2001). The smoke was blown through a `barley straw directly into the cavities.

***Physostigma venenosum* Balf. (Fabaceae). calabar bean.**

Smoke from seeds burned in a calabash was considered useful for treating asthma in the children of the Democratic Republic of Congo (Disengomoka et al. 1983).

***Phytolacca dodecandra* L'Her. (Phytolaccaceae). endod.**

Smoke from burning wood was inhaled in Ethiopia to decrease the sexual ability of males (Esser et al. 2003).

***Picea abies* (L.) H. Karst. (Pinaceae). Norway spruce.**

The resins of this species were often burned as incense during Nordic Christmas celebrations, often in combination with *Artemisia vulgaris* L., *Juniperus communis* L., and *Taxus baccata* L. (Rätsch 2004). The resins were also smoked by Siberian shamans.

***Picea canadensis* Link (Pinaceae). Canadian white spruce.**

The Flambeau Ojibwa of North America inhaled the smoke of burning leaves for the relief of a variety of respiratory illnesses (Smith 1932).

***Picea glauca* (Moench.) Voss. (Pinaceae). white spruce.**

Spruce cones and rotten vegetation were burned in the Ft. Yukon region of Alaska to smoke moose hides (Holloway and Alexander 1990).

Picea glauca

***Picea rubens* Sarg. (Pinaceae). red spruce.**

Icelandic people burned the spruce cones on coals and then inhaled the smoke to "make a man happy" and to help moisten the body. It was also considered good for illnesses of the blood (Bjornnson 1475). Resin obtained from the bark was collected in the winter for use as incense.

***Piliostigma thonningii* (Schumach.) Milne-Redh. (Fabaceae). camel foot.**

In Bulamogi County, Uganda, where this plant is known as *mulama*, smoke from burning roots was inhaled to treat insanity (Tabuti et al. 2003).

***Pimenta dioica* (L.) Merr. (Myrtaceae). allspice.**

Many Jamaican flavored jerked foods were smoked with pimenta wood (Bogenschtz-Godwin and Ducellier 2002).

***Pimpinella anisum* L. (Apiaceae). anise burnet saxifrage.**

According to Avicenna, smoke from burning fruits was inhaled to treat pain and as a remedy for vertigo in Iran (Mohagheghzadeh et al. 2006).

***Pinus banksiana* Lamb. (Pinaceae). jack pine.**

The Potawatomi of North America burned the leaves and inhaled the smoke to clear out the lungs and to revive comatose patients (Smith 1933). The Woodland Cree, also of North America, burned dry and open cones along with rotten white spruce wood to smoke animal hides (Leighton 1985).

Pinus banksiana

***Pinus cembroides* Zucc. (Pinaceae). Mexican pinyon.**

Mexican pinyon smoke was screened for its ability to affect the mortality of honeybees (*Apis mellifera*) and tracheal mites (*Acarapsis woodi*) (Eischen and Vergara 2004). It exhibited a low but statistically valid effect.

***Pinus edulis* Engelm. (Pinaceae). pinyon pine.**

Native Americans inhaled smoke from burning branches for coughs, colds, and rheumatism (Duke 2000). Fumes from burning pitch were inhaled for head colds, coughs, and earaches. North American Mescalero Apaches inhaled smoke from burning needles for colds (Basehart 1974), and the Hualapai burned fresh white pitch for smoke that was used to purify the air (Watahomigie 1982). The Ramah Navajo of North America. inhaled the fumes of burning resin for head colds (Vestal 1952). The Hopi and Tewa, also of North America, placed gum obtained from the species on hot coals to fumigate their clothes and themselves after a funeral (Colton 1974). The gum was often burned along with different birds by the Navajo as incense for ceremonial purposes (Hocking 1956). The Ute Mountain Ute of Colorado burned this pine to smoke animal hides for use as bags and tepee coverings (Dunmire and Tierney 1997).

Pinus edulis

***Pinus flexilis* E. James (Pinaceae). limber pine.**

The Ramah Navajo of North America smoked the plant to bring them good luck during hunting expeditions (Vestal 1952).

***Pinus monophylla* Torr. & Frém. (Pinaceae). single leaf pinyon.**

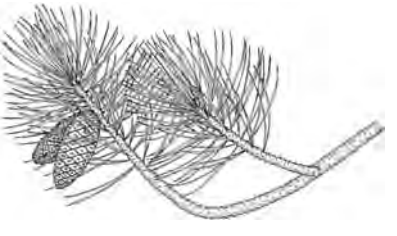
The Shoshone of North America inhaled the smoke of burning pitch compound to treat colds (Train et al. 1941). The smoke was also used for veterinary purposes. Horses with distemper were made to inhale it as a remedial treatment. The Cahuilla of California burned the wood for the pleasant odors it emitted (Bean and Saubel 1972).

***Pinus nigra* Ait. (Pinaceae). Austrian pine.**

The resin was burned in Iran and Turkey for smoke that was used to treat eye complaints according to Avicenna (Mohagheghzadeh et al. 2006).

***Pinus ponderosa* Douglas ex P. Lawson & C. Lawson (Pinaceae). ponderosa pine.**

The Okanagan-Coville of North America burned rotten ponderosa pine wood to smoke deer hides (Turner et al. 1980). The Shuswap of North America smoked buckskin hides with the wood (Palmer 1975). The Upper and Lower Thompson of North America also used the wood to smoke skins (Steedman 1928).



Pinus ponderosa

***Pinus pseudostrobus* Lindl. (Pinaceae). smooth-bark Mexican pine.**

The northern Lacandon Maya of the lowland Chiapes of southern Mexico burned resin obtained from the trunk for incense purposes (McGee 1990). Young boys were sent to harvest

the sap from this species. They made diagonal cuts along the trunk and allowed the sap to flow into a leaf base, where it was collected. The sap was later pounded into a thick paste and stored in large gourds in the "God House." According to the Lacandon, the incense they burned turned into tortillas, which their god consumed as food. The resin of this species was considered the source of pom copal and was burned ritually as incense by the Momostenango of Guatemala. The resin was typically wrapped in two pieces of pumpkin skin. Elsewhere, it was wrapped in corn husks and burned for smoke that was used to disinfect huts during certain ceremonies (de Jongh Osborne 1975).

***Pinus resinosa* Ait. (Pinaceae). red pine.**

The Potawatomi of North America burned the leaves as a fumigant to stimulate the revival of a comatose person (Smith 1933).

***Pinus rigida* Mill. (Pinaceae). pitch pine.**

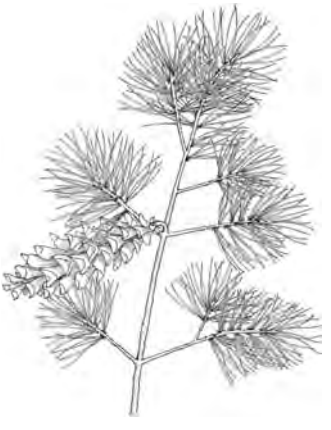
Members of New England tribes of North America burned the bark of the pitch pine to preserve their cakes (Hussey 1974). The Cherokee of North America used the smoke to repel fleas (Herrick 1977).

***Pinus* spp. (Pinaceae). pines.**

The Ojibwa of North America burned the needles and inhaled the smoke to relieve headache and backache (Hoffman 1891). The Iroquois used dried roots to roll into cigars to smoke for pleasure (Rousseau 1945). The Aztec of Mexico burned pine resin as incense and to treat insanity (Rätsch 2004). It was also used by a variety of shamans, often in a mixture with other herbs, especially to protect homes and other property. When mixed with *Nicotiana rustica* L., it may induce hallucinogenic visions.

***Pinus strobus* L. (Pinaceae). eastern white pine.**

The smoke of the bark of this species was used by the New England people of North America to preserve their cakes (Hussey 1974). Gerarde (1633) reported that smoke produced by the burning of rosin (resin) was used as "medicines that beautifie the eie lids [eye lids]." It was also reported that the smoke could cure sores at the corners of the eyes as well as watering of the eyes. The Iroquois of North America burned the needles during the spring and fall, using the smoke to fill the house to prevent all illnesses (Herrick 1977). The smoke was also used to fumigate and protect people who had seen a dead person.



Pinus strobus

***Pinus succinifera* (Goeppert) Conwentz (Pinaceae). amber gum.**

Fossilized resin, or amber, from this prehistoric and extinct pine tree, which existed along the Baltic region of northern Europe during the Oligocene epoch (50 million years ago), was burned in ancient times as incense to treat respiratory tract complaints (Rätsch 2004).

***Pinus yunnanensis* Franch. (Pinaceae). Yunnan pine.**

The Shuhi of southwestern China burned fresh branches of this pine as incense (Weckerle et al. 2006). Interestingly, it was not used as firewood because it reportedly produced too much smoke.

***Piptadenia peregrina* (L.) Benth. (Fabaceae). cohoba.**

The bark of cohoba was burned for ritual incense use in Brazil's state of Pará, where it was readily available for purchase under the local name of *paricá* in the Ver-o-Peso markets of Belém (van den Berg 1984).

***Pistachia khinjuk* Stocks (Anacardiaceae). gwân.**

In the Khuzdar bazaar area of southern Pakistan, a pea-sized ball of exuded gum was mixed with grain flour and sugar and then smoldered over hot coals so that the people could inhale the smoke to relieve coughs (Goodman and Ghafoor 1992). The smoke was also considered useful for treating open sores. Those using the smoke had to do so with their eyes closed and were required to inhale as much of it as possible.

***Pistacia lentiscus* L. (Anacardiaceae). chios mastic tree.**

In Cyprus (Georgiades 1987a) and in Sardinia, Italy (Bogenschtz-Godwin and Ducellier 2002), meats were flavored with wood smoke produced by burning this species. It was often burned as incense in Vietnam (van Duong 1993). The Cypriot name for the plant is *schinia*.

Pistacia lentiscus

***Pistacia terebinthus* L. (Anacardiaceae). terebinth.**

According to Avicenna, smoke from burning fruits was used as a treatment for sore eyes in Iran (Mohagheghzadeh et al. 2006).

***Planchonella obovata* (R. Br.) Pierre. (Sapotaceae). black ash.**

The wood of black ash was burned in India's Nicobarese birth houses (Dagar and Dagar 2000).

***Plectranthus igniarius* (Schweinf.) Agnew (Lamiaceae). Plectranthus.**

Smoke generated in saunalike chambers was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Pleurospermum brunonis* Benth. ex C. B. Clarke (Apiaceae). Pleurospermum.**

This species was burned for incense purposes in India (von Reis and Lipp 1982).

***Pluchea leubnitziae* N. E. Br. (Asteraceae). bitteros.**

The Kuanyama Ango of Angola considered the smoke generated by burning the complete plant an ideal cold remedy (Loeb et al. 1956).

***Podocarpus falcatus* (Thunb.) Mirb. (Podocarpaceae). outeniqua yellowwood.**

The bark was burned in Zulu cattle kraals of South Africa as a charm to prevent cattle from straying (Hutchings et al. 1996).

***Podocarpus totara* G. Benn. ex D. Don. (Podocarpaceae). totara.**

The Maori of New Zealand burned the wood and used the smoke to treat skin complaints, piles, and venereal diseases (Brooker and Cooper 1962).

***Pogostemon hortensis* Back. ex Adelb. (Lamiaceae). patchouli.**

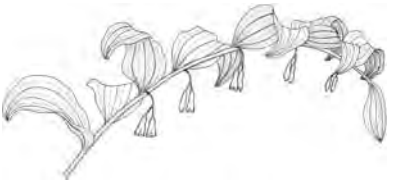
The leaves and branches of this species were used for the preparation of incense materials in Java, Indonesia (Sangat-Roemantyo 1990).

***Polyalthia jenkinsii* (Hook. f. & Thomas) Hook. f. & Thomas (Annonaceae). Polyalthia.**

On the Nicobar Islands of India, natives warmed and fumigated the bodies of their infants over the smoke of fires made with the leaves of this species. This was said to help them grow quickly (Dagar and Dagar 1999).

***Polygonatum biflorum* Elliott (Convallariaceae). King Solomon's seal.**

The Meswaki of North America heated the roots over hot coals and used the fumes to revive unconscious people (Smith 1923). The Chippewa, also of North America, burned the roots for their fragrant smoke to promote sleep (Gilmore 1933).



Polygonatum biflorum

***Polygonatum biflorum* Elliott var. *commutatum* Morong (Convallariaceae). smooth Solomon's seal.**

The roots of this species, which was reported as *Polygonatum commutatum* A. Dietr. in original texts, were burned by the Chippewa of North America for their pleasant fragrances (Gilmore 1933).

***Polygonatum pubescens* Pursh. (Convallariaceae). hairy Solomon's seal.**

After the roots were dried and pulverized, they were mixed with the leaves and twigs of cedar trees and then burned as a smudge, the smoke of which was blown into the nostrils of a dying person. The Menomini of North America believed that the smoke could bring dying people back to life (Smith 1923).

***Polygonum muhlenbergii* S. Wats. (Polygonaceae). swamp persicaria.**

The Flambeau Ojibwa of North America smoked this and other species as a hunting medicine to attract deer (Smith 1932).

***Polyporus guaraniticum* Speg. (Polyporaceae). Polyporus.**

The fruits of this species were burned to prepare fumigants that were said to wean children in the Maka society of the Paraguayan Chaco (Arenas 1987).

***Polyscias fruticosa* Harms. (Araliaceae). ming aralia.**

In Indo-China, smoke from burning leaves was considered a useful sudorific and antivertiginous treatment (Menaut 1929).

***Populus angustifolia* James (Salicaceae). narrowleaf cottonwood.**

The Montana of North America used the inner bark of this species in their kinnikinnick mixtures (Blankinship 1905).

***Populus balsamifera* L. (Salicaceae). balsam poplar.**

The Inuktitut Eskimo of North America burned the bark to generate smoke for its mosquito-repelling qualities (Wilson 1978). Leaf galls were smoked for pleasure with and without tobacco (*Nicotiana* spp.). For the Dena'ina of Alaska, this was one of their favorite woods for smoking fish (Kari 1995). The Montana used the inner bark of this species in their kinnikinnick mixtures (Blankinship 1905). They burned the wood to smoke and preserve their fish, and the wood ash was mixed with tobacco to be smoked for pleasure (Blankinship 1905).

***Populus balsamifera* L. ssp. *balsamifera* (Salicaceae). balsam poplar.**

In Alaska's Ft. Yukon region, the wood smoke of this species was used to preserve fish (Holloway and Alexander 1990). Dry, rotten wood was also used to smoke animal skins.

***Populus balsamifera* L. ssp. *trichocarpa* (Torr. & A. Gray ex. Hook.) Brayshaw (Salicaceae). black cottonwood.**

The Shuswap of North America burned the wood to smoke buckskins (Palmer 1975). The Montana used the inner bark of this species in their kinnikinnick mixtures (Blankinship 1905). The species mentioned in the original text was *Populus trichocarpa* Torr. & A. Gray.

Populus balsamifera ssp. *trichocarpa*

***Populus tremuloides* Michx. (Salicaceae). American aspen.**

The Upper Tanana of Alaska used smoke from burning wood to preserve their fish (Kari 1985). The Woodland Cree of North America, in contrast, smoked the plant during ceremonies (Whiting 1939). They used the inner bark in their kinnikinnick mixtures (Blankinship 1905). The species mentioned in the original text was *Populus aurea* Tidestr.

***Pothos scandens* L. (Araceae). devil's ivy.**

Das et al. (1983) reported that the stems of this species were burned in an unspecified country with camphor to produce smoke that was inhaled to treat asthma.

***Pourouma ovata* Trécul (Cecropiaceae). Pourouma.**

The Waimiri Atroari of Brazil claimed that the smoke generated by burning the wood of this species irritates the lungs (Milliken et al. 1992).

***Premna oligotricha* Baker (Verbenaceae). Premna.**

This species was used to fumigate and cleanse gourds both in Ethiopia and Kenya's Marsabit District because its smoke produces a pleasant smell (Heine and Brenzinger 1988).

***Prosopis glandulosa* Torr. (Fabaceae). honey mesquite.**

The smoke of honey mesquite was tested for its effects on the mortality of honeybees and tracheal mites (Eischen and Vergara 2004). It exhibited low yet significant mortality.

***Prostanthera* sp. (Lamiaceae). mint bush.**

In Australia's Northern Territory, leafy branches of a species of mint bush were placed on hot coals to produce smoke that was inhaled for nasal congestion (Barr 1993).

***Protasparagus laricinus* (Burch.) Oberm. (Asparagaceae). wild asparagus.**

The Tswana and Kwena of Africa inhaled the smoke generated by burning whole plants for "diseases of women" (Watt and Breyer-Brandwijk 1962).

***Protium altsonii* Sandwith (Burseraceae). Protium.**

The dried latex of this species was sold in the markets of La Paz and El Alto, Bolivia. The smoke from burning latex was inhaled to treat aire (Macía et al. 2005).

***Protium attenuatum* Urb. (Burseraceae). encens.**

This is yet another genus within the family Burseraceae known for its production of oleo-gum resins that were burned for incense. This species produces a resin that was considered ideal for incense by the natives of Santo Domingo in the Dominican Republic and St. Lucia in the West Indies (Uphof 1968; Longwood 1971; Usher 1974).

***Protium carana* March. (Burseraceae). carana.**

The aromatic resins of this species were used in parts of Colombia, where shamans added it to tobacco (*Nicotiana* spp.) or coca (*Erythroxylum coca* Lam.) leaves and burned the mixture as incense during certain ceremonies (Rätsch 2004).

***Protium chapelieri* Guillaumin (Burseraceae). Protium.**

Resin harvested from this species, known as *remy*, was burned as incense in Madagascar (Uphof 1968; Usher 1974).

***Protium copal* (Schlect. and Cham.). Engl. (Burseraceae). copal.**

The ancient Maya of Central America prized the resin for burning as incense (Uphof 1968). The resin was specifically burned as incense by the Huastec Maya during ritual offerings (Stross 1997) and other important ceremonies, such as funerals, Catholic mass, and when attempting to communicate with gods (Alcorn 1984). The smoke was also used to treat stomach pain, fright, and dizziness and to stop heavy rain. This is one of the most sacred trees of the ancient Maya. The San Andréas of Petén, Guatemala, in contrast, burned the resin to fumigate the bodies of sick people. The smoke was said to expel the sickness (Comerford 1996). South American chicleros (people who harvested the latex of the chicle tree) burned the resin to ward off evil spirits (Arvigo and Balick 1993).

Protium copal

***Protium crassipetalium* Webbia. (Burseraceae). Protium.**

This species was much sought after by the Kuripakos of the Amazon who burned its resin for unspecified purposes (Schultes and Raffauf 1990).

***Protium crenatum* Sandwith (Burseraceae). kurokai.**

The oleo-gum resins harvested from the bark of this species were burned as incense in churches in the Caribbean (Longwood 1971).

***Protium decandrum* March. (Burseraceae). copal caspi.**

The Galibis of French Guiana often burned the yellow, transparent resin harvested from the bark of this tree as incense in churches (Plotkin et al. 1991). The resin is usually collected from the bark as a resinous and balsamic liquid that changes in color from white to yellow when it is dried. The resin was also burned as incense in Caribbean churches (Longwood 1971).

***Protium guianense* March. (Burseraceae). haiawa.**

The people of Cayenne, French Guiana, split the bark of this species and collected the resinous balsamic sap, which they then dried and burned in churches as incense (Plotkin et al. 1991). It was also burned elsewhere in tropical America as incense (Usher 1974).

***Protium heptaphyllum* March. (Burseraceae). breu blanco.**

This was another of the species used in tropical America for its resin (elmira resin) (Uphof 1968; Usher 1974). The Tanimuka of the Amazon burned the resin to produce smoke to scent coca (Schultes and Raffauf 1990). The resin was sold for ritual

incense use at the Amazonian markets of Ver-o-Peso in Belem in the state of Pará, Brazil (van den Berg 1984). The Galibis of French Guiana burned the whitish resin to perfume their houses (Plotkin et al. 1991).

***Protium icicariba* March. (Burseraceae). breu.**

This is the most important commercial species of *Protium*. Its resin is fragrant and burned in Brazil for incense purposes (Mors and Rizzini 1966). The Tembé and Ka'apor of eastern Amazonia also burned breu as incense (Balée 1994).

***Protium rhynchophyllum* Rusby. (Burseraceae). Protium.**

The Tacana of northwestern Bolivia burned the wood of this species of *Protium* to smoke cure their rubber (De Walt et al. 1999).

***Protium sagotianum* March. (Burseraceae). balsamo.**

In parts of French Guiana (Fanshawe 1948) and the Caribbean (Longwood 1971), the resin of this species was collected and used for incense purposes.

***Protium schomburgkianum* Engl. (Burseraceae). kurokai.**

Resins obtained from the bark of this species were sometimes burned as incense in churches in the Caribbean (Longwood 1971).

***Protium spruceanum* Engl. (Burseraceae). Protium.**

The Alter do Chão of Pará, Brazil, inhaled the smoke of burning resin to relieve headaches (Branch and Gersgoff 1990). The Ka'apor of Brazil used the resin to add flavor to their tobacco (*Nicotiana* spp.) (Balée and Daly 1990).

***Prunus dulcis* (Mill.) D. A. Webb var. *amara* (De Candolle) H. E.Moore (Rosaceae). sweet almond.**

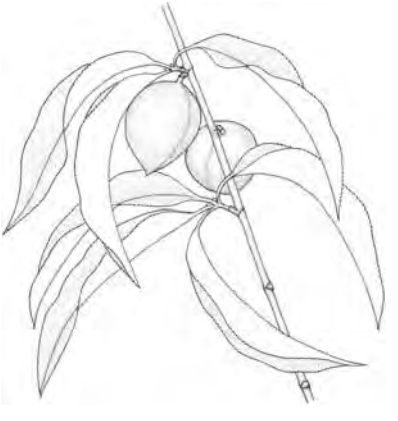
In Iran, the fruits were burned to produce smoke that was used to purify the air (Mohagheghzadeh et al. 2006). This species was originally reported as its synonym, *Amygdalus communis* L. var. *amara* (DC.) Fock (Rosaceae).

***Prunus mume* Siebold and Zucc. (Rosaceae). Japanese apricot.**

In China, this plant, when smoked, was believed to be an antispasmodic, a febrifuge (Jiangsu New Medical College 1979), and a carminative agent (Bliss 1973; Keys 1976; Perry 1980).

***Prunus persica* (L.) Batsch (Rosaceae). peach.**

Villagers in northern Thailand's Lahu area believed that fumigations of unspecified parts of this species kept evil spirits away (Anderson 1993).



Prunus persica

***Prunus* spp. (Rosaceae). plums.**

Essences of fruits, such as prunes and peaches, have been used to flavor cigarettes in various parts of the world (Lewis and Elvin-Lewis 2003).

***Pseudima frutescens* Radlk. (Sapindaceae). Savonier.**

In parts of French Guiana, smoke from burning leaves was used as an external fumigant to treat general gynecological disorders (Defilipps et al. 2004).

***Pseudocedrela kotschyi* Harms (Meliaceae). Mubumbu.**

In Bulamogi County, Uganda, the roots and leaves of this species were smoked to keep evil spirits at bay (Tabuti et al. 2003).

***Pseudognaphalium obtusifolium* (L.) Hilliard & Burtt. (Asteraceae). rabbit tobacco.**

Seriously ill Hocak (Winnebago) of North America were fumigated with this species, when burned, to revive them (Kindscher and Hurlburt 1998).

***Pseudolachnostylis maprouneifolia* Pax. var. *maprouneifolia* (Euphorbiaceae). kudu berry.**

In Namibia, smoke from smoldering roots was inhaled to treat pneumonia (von Koenen 2001).

***Pseudotsuga menziesii* (Mirb.) Franco (Pinaceae). Douglas fir.**

The Thompson of British Columbia, Canada, gathered the rotten wood of this species and burned it to smoke cure their animal hides (Turner et al. 1990).

***Psoralidium tenuiflorum* (Pursh) Rydb. (Fabaceae). slimflower scurfpea.**

The Lakota of the Dakotas in the United States used this plant in the preparation of smoke smudges that repelled mosquitoes (Rogers 1980). The Ramah Navajo of western New Mexico smoked the leaves for the treatment of influenza (Vestal 1952).

***Psorospermum senegalense* Spach (Hypericaceae). hùndà túkúnyá.**

The Fula of Guinea-Bissau fumigated themselves with the smoke of burning bark to confer protection against evil spirits (Kerharo and Adam 1964a cited in Burkill 1994).

***Psychotria* cf. *zevallosi* (Standl.) C. M. Taylor (Rubiaceae). wild coffee.**

The Shuar of eastern Ecuador mixed the leaves with their tobacco (*Nicotiana* spp.) and smoked the mixture for pleasure (Schultes and Raffauf 1990).

***Pteris aquilina* L. (Pteridaceae). bracken fern.**

According to Culpeper (1998), the smoke generated by burning unspecified parts of this fern was useful in driving away snakes, gnats, and noisy creatures. Gerarde (1633) suggests that fumigating an aching thigh (sciatic) would reduce pain in that area. The Flambeau Ojibwa of North America placed dried leaves on live coals and inhaled the smoke they produced to relieve headaches (Smith 1932).

***Pterocarpus santalinus* L. f. (Fabacaeae). red sandalwood.**

This species was added to incense materials to give their smoke beautiful colors (Rätsch 2004).

***Pterocaulon globuliflorus* W.Fitzg. Niveum Cabrera and Ragonese (Asteraceae). Pterocaulon.**

The native people of Australia's Northern Territory burned the entire plant and inhaled the smoke to treat respiratory problems (Barr 1993).

***Pterospora andromedea* Nutt. (Monotropaceae). woodland pinedrops.**

The Jemez of Albuquerque, New Mexico, smoked the leaves in their kivas (special ceremonial chambers) for ceremonial purposes (Cook 1930).

***Pterygota alata* (Roxb.) R. Br. (Sterculiaceae). Buddha's coconut.**

In Pakistan, the seeds of this species were often smoked as an opium substitute (Lewis and Elvin-Lewis 2003).

***Pycnocarpus sanguineus* (L.) Murril. (Polyporaceae). Pycnocarpus.**

The fruits were used to prepare fumigants that were said to wean children in the Maka society of the Paraguayan Chaco (Arenas 1987).

***Pyrostria phyllantheoidea* (Baill.) Brids. (Rubiaceae). Pyrostria.**

In southern Oromia, Ethiopia, the smoke generated by burning unspecified parts of this species was used to perfume and cleanse Borana women (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms.

***Quararibea funebris* (Llave) Vischer (Bombacaceae). funeral tree.**

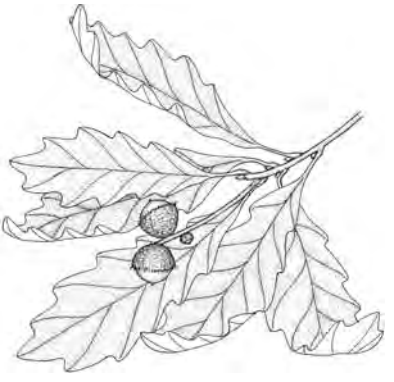
In Mexico, the ancient Aztec added the flowers of the cacauaxochitl plant to their tobacco (*Nicotiana* spp.) and smoked the mixture for its psychoactive properties (De Sahagún 1961).

***Quercus bicolor* Willd. (Fagaceae). swamp white oak.**

A compound of the leaves was smoked and exhaled through the nose by the Iroquois of North America to treat catarrh (Herrick 1977).

***Quercus guajavifolia* H. Lév. (Fagaceae). Mao dou li.**

The shamans, or *dumbus*, of a Tibeto-Burman ethnic group known as the Shuhi of southwest China often burned the branches of this oak as incense (Weckerle et al. 2006). *Mao dou li* is the Chinese name for this plant.



Quercus bicolor

***Quercus robur* L. (Fagaceae). English oak.**

According to Avicenna, Persians inhaled smoke from burning wood to relieve diarrhea and to reduce pain (Mohagheghzadeh et al. 2006).

***Ranunculus affinis* R. Br. (Ranunculaceae). northern buttercup.**

The flowers of the northern buttercup were burned for incense purposes in China (von Reis and Lipp 1982).

***Ranunculus multifidus* Forssk. (Ranunculaceae). wild buttercup.**

The Sotho of South Africa inhaled the smoke produced by burning the entire plant to treat headaches (Jacot Guillarmod 1971).

***Ranunculus pensylvanicus* L. f. (Ranunculaceae). Pennsylvania buttercup.**

Smoke from burning seeds was used by the Flambeau Ojibwa of North America as a hunting aid to lure buck deer to within arrow range (Smith 1932).

***Rhamnus crocea* ssp. *ilicifolia* (Kellogg) C. B. Wolf (Rhamnaceae). hollyleaf buckthorn.**

This plant was specifically burned for smoke that was inhaled to treat headaches and rheumatism by the Kawaiisu of southeastern California (Zigmund 1981). The species reported in original texts was *Rhamnus ilicifolia* Kellogg.

Rhamnus crocea ssp. *ilicifolia*

***Rhazya stricta* Decne. (Apocynaceae). harmal.**

In the Dhofar region of southern Oman, smoke from smoldering plants was inhaled to relieve headaches and constriction of the chest as well as various respiratory ailments (Miller and Morris 1988). The leaves also were thrown on campfires at night to protect sleepers from evil. The smoke from burning stems was considered a useful fumigant for relieving itchiness. *Harmal* is a Dhofari Arabic name that should not be confused with African rue, *Peganum harmala* L.

***Rheum moorcroftianum* Royle (Polygonaceae). archa.**

In parts of Nepal, the dried leaves of this species were smoked in a pipe to treat sinusitis (Manandhar 2002).

***Rhizophora apiculata* Blume (Rhizophoraceae). mangrove.**

Smoke generated from mosquito coils prepared with the leaves and still roots of this mangrove species was used to repel or kill mosquitoes (Thangam and Kathiresan 1992).

***Rhizophora mangle* L. (Rhizophoraceae). red mangrove.**

In Panama, the fruits, when dried, were smoked for pleasure in pipes or as cigars (Duke 1968).

***Rhizophora racemosa* G. Mey. (Rhizophoraceae). American mangrove.**

In parts of Oceania, this plant was burned to smoke fish (Banadaranayake 1998), giving it color and flavor. Asita and Campbell (1990) reported that the wood of this mangrove could be burned to produce smoke that effectively inhibited two species of bacteria—*Staphylococcus aureus* and *Saccharomyces cerevisiae*—both of which are known to spoil food.

***Rhododendron anthopogon* D. Don (Ericaceae). anthopogon oil.**

The dried leaves of this species, when burned, produce smoke that was considered ideal for incense use in Nepal (Pohle 1990; Manandhar 2002). In the Sikkim Himalayas of India, the whole plant was burned as incense (Pandey 1991). Elsewhere in the Himalayas, smoke from unspecified parts of this plant was inhaled to treat various diseases and to induce sneezing (Tsarong 1986).

***Rhododendron anthopogon* D. Don ssp. *hypenanthum* (Balf. f.) H. Hara (Ericaceae). anthopogon oil.**

In India's Lahoul Valley (northwestern Himalayas), the Shashin tribe burned powdered roots of this species for incense purposes (Sood et al. 2001). The local name for this plant is *koont*.

***Rhododendron campanulatum* D. Don (Ericaceae). Rhododendron.**

The leaves of this rhododendron, which is a Greek word for rose tree, were smoked in Nepal to treat colds and hemicrania (Tsarong 1986).

***Rhododendron lepidotum* Wall. ex. G. Don. (Ericaceae). red flowered rhododendron.**

This species was burned for incense purposes in Nepal (Manandhar 2002).

***Rhododendron trichostomum* Franch. (Ericaceae). sigae.**

The Shuhi of southwestern China burned the branches and leaves of this plant as incense (Weckerle et al. 2006). The quality of the smoke was important, especially when communicating with deities. White smoke was considered ideal.

***Rhus aromatica* Ait. (Anacardiaceae). fragrant sumac.**

Red leaves were gathered by the Michaelma of North America to mix with tobacco (*Nicotiana* spp.) to give it a pleasant aroma (Carver 1778; Zeisberger 1779). The leaves were mixed in equal proportions with tobacco leaves and were commonly used in peace pipes, which was similar to the European flag of truce. The Creek, Chocktaw, and other southern tribes diluted their tobacco with the leaves of this species (Campbell 1951). The Lakota of North America mixed the leaves with tobacco (Rogers

Rhus aromatica

1980). The Oklahoma Delaware of North America mixed both the leaves and roots with tobacco and smoked the mixture during various ceremonies (Tantaquidgeon 1942).

***Rhus coriaria* L. (Anacardiaceae). Sicilian sumac.**

The smoke generated by burning the leaves of the Sicilian sumac was used to kill insects (McIndoo 1945).

***Rhus glabra* L. (Anacardiaceae). smooth sumac.**

Rhus glabra

Like so many North American tribes, the Iroquois mixed the leaves of this species with those of tobacco (*Nicotiana* spp.) and smoked them for pleasure (Bye 1970; Lewis and Elvin-Lewis 2003). Other Native Americans mixed the berries, leaves, and roots with tobacco (Kavasch 1979). The Delaware mixed the leaves with tobacco for flavor, relaxation, and pleasure (Weslager 1973). In the Appalachians, other Native American tribes smoked the leaves to relieve asthma (Krochmal et al. 1969; Krochmal and Krochmal 1973). The Comanche (Campbell 1951), Chippewa (Gilmore 1933), Gosiute (Chamberlin 1911), Kiowa (Vestal and Schultes 1939), Lakota (Rogers 1980), and Plains people (Hart 1996) all mixed the leaves with tobacco and smoked the mixture. The Dakota gathered the scarlet leaves in the fall and smoked them after they were dried (Gilmore 1913a). They also collected the red leaves to mix them with tobacco, as did the Pawnee, Ponca, and Hocak (Gilmore 1919). The Okanagan-Coville dried red leaves, deveined them, and broke them up into fine pieces and smoked them in the absence of kinnikinnick (Gilmore 1913b).

***Rhus leptodictya* Diels (Anacardiaceae). mountain karree.**

In Venda, South Africa, the smoke of the roots and bark of this plant were inhaled under a blanket to treat headaches (Arnold and Gulumian 1984).

***Rhus parviflora* Roxb. (Anacardiaceae). sati bayar.**

In Nepal, where this species is known as *sati bayar*, the leaves were added to tobacco (*Nicotiana* spp.) to give it a better flavor (Manandhar 2002).

***Rhus potaninii* Sieb. & Zucc. (Anacardiaceae). Potanini's lacquer tree.**

Although there is no evidence to suggest that the smoke of this species can irritate skin and respiratory surfaces, it is likely that it will because the species is known to produce harmful substances that may be carried along with smoke particulates.

***Rhus sempervirens* Scheele (Anacardiaceae). evergreen sumac.**

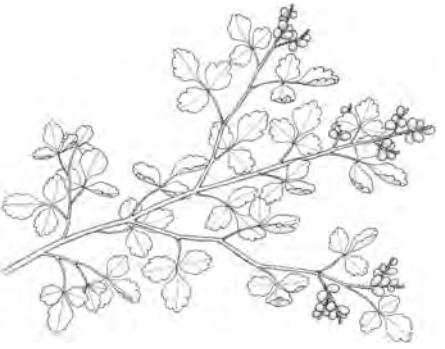
Native Americans of Texas smoked the leaves for recreational purposes and used them to flavor tobacco (*Nicotiana* spp.) (Uphof 1968; Usher 1974; Lewis and Elvin-Lewis 2003). The Kickapoo of North America also mixed the leaves with tobacco for flavor (Latorre and Latorre 1977).

***Rhus tenuinervis* Engl. (Anacardiacese). Kalahari currant.**

The Kwanyama of Namibia used the smoke from burning branches to drive bees away from their hives (von Koenen 2001).

***Rhus trilobata* Nutt. ex Torr. & A. Gray (Anacardiaceae). skunkbush sumac.**

Various Native Americans smoked the leaves of this species with those of tobacco (*Nicotiana* spp.) (Uphof 1968; Lewis and Elvin-Lewis 2003). These included the Keresan (White 1945) and the Kiowa (Vestal and Schultes 1939). See also *Schmaltzia bakeri* Greene.



Rhus trilobata

***Rhus trilobata* Nutt. ex Torr. & A. Gray var. *trilobata* (Anacardiaceae). skunkbush sumac.**

The Kiowa of North America mixed the leaves of this species with their tobacco (*Nicotiana* spp.) (Vestal and Schultes 1939). See also *Schmaltzia bakeri* Greene.

***Rhus typhina* L. (Anacardiaceae). staghorn sumac.**

The Forest Potawatomi of North America added the leaves of this species to tobacco (*Nicotiana* spp.) to make it "smoke pleasantly" (Smith 1933).

***Rhus virens* Lindh. ex A. Gray (Anacardiaceae). tobacco sumac.**

In parts of the United States and Mexico, Native Americans smoked the leaves of the tobacco sumac for pleasure and also mixed them with tobacco (*Nicotiana* spp.) (Uphof 1968; Lewis and Elvin-Lewis 2003).

***Ricinus communis* L. (Euphorbiaceae). castor-oil tree.**

According to the Ayurveda of India, parts of this plant were macerated, then smeared with ghee, and finally rolled into a cigarette that was smoked to relieve asthma (Mishra 2003). In the northern parts of Nigeria, smoke from burning stems was used as a fumigant for unspecified purposes (Dalziel 1948). In Yemen, the smoke from burning dried leaves was used to cure bad breath (Ghazanfar 1994). In ancient Egypt, fumigations prepared with this species were used to expel diseases caused by demons (Manniche 1989). This species was also a key ingredient in a concoction of plants and animals that, when burned to produce smoke, was reported to cause blindness in one's enemies. This was according to the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya* (recipe 2 under *Asparagus racemosus* Willd.) (Sensarma 1998). Recipe 4 under *A. racemosus* reveals that this species was used in another polyherbal recipe that was burned to produce lethal smoke to animals. See also *Nerium odorum*.

Ricinus communis

***Rinorea ilicifolia* Kuntze (Violaceae). mlimba.**

Pregnant women in parts of East Africa used the leaves of this species, known locally as *mlimba,* as incense during unspecified medicinal practices (Heine and Legére 1995).

***Roldana sessifolia* (Hook. & Arn.) H. E. Robins & Brett. (Asteraceae). groundsel.**

Smoke from burning roots was inhaled to cure headaches and nosebleeds in central Mexico (Linares and Bye 1987).

***Rosa arkansana* Porter var. *suffulta* Cockerell (Rosaceae). prairie rose.**

North American natives, including the Dakota, the Pawnee, Ponca, and Omaha, smoked the inner bark of this species with or without tobacco (Gilmore 1919). The species reported in original texts was *Rosa pratincola* Greene.

***Rosa damascena* Mill. (Rosaceae). Damask rose.**

According to Avicenna, the fumes of burning flowers were used in Iran as pest repellents (Mohagheghzadeh et al. 2006).

***Rosa gymnocarpa* Nutt. (Rosaceae). dwarf rose.**

The Okanagan-Coville and Thompson of British Columbia mixed the leaves of this species with those of other plants and smoked the mixture (Perry 1952).

***Rosa woodsii* Lindl. (Rosaceae). wood's rose.**

The Ute Mountain Ute of Colorado were reported to have made pipe stems from rosewood and smoked the inner bark of this species for pleasure (Dunmire and Tierney 1997).

***Rosmarinus officinalis* L. (Lamiaceae). rosemary.**

In Ecuador, the entire plant was burned for incense purposes (Joyal 1987). In Belize, rosemary was burned with copal resin (probably from *Protium copal* [Schlect. & Cham.]. Engl. but could have been from other sources) to ward off evil spirits and envy (Arvigo 1994). According to Usher (1974), the smoke from burning dried leaves produces smoke that can disinfect houses. It was also inhaled to treat asthma and bronchitis.

Rosmarinus officinalis

***Rothmannia capensis* Thunb. (Rubiaceae). cape gardenia.**

The Rozi, who were scattered throughout Africa, burned the roots of cape gardenia and inhaled the smoke to treat wounds and burns (Watt and Breyer-Brandwijk 1962).

***Ruellia californica* (Rose) I. M. Johnst. (Acanthaceae). Ruellia.**

The Seri of Mexico smoked unspecified parts of this plant to induce hallucinations or to "make one crazy" (Felger and Moser 1985). There was some ambiguity regarding which part of the plant was used, however. Some informants claimed that it was the leaves, but others suggested it was the flowers.

***Rumex crispus* L. (Polygonaceae). curled dock.**

According to Smith (1932), the Flambeau Ojibwa of North America mixed this species with other unspecified species and smoked the mixture to lure game.

Ruta graveolens

***Rumex orbiculatus* A. Gray. (Polygonaceae). great water dock.**

The Flambeau Ojibwa of North America smoked dried seeds of this dock to lure game (Smith 1932).

***Ruta chalepensis* L. (Rutaceae). fringed rue.**

The Criollos of northwestern Argentina inhaled the smoke of burning leaves with chips of *Bulnesia sarmientoi* Lorentz ex Griseb and exhaled into the ears of otitis sufferers (Scarpa 2004). In the Madeira archipelago, the leaves were smoked to treat apoplexy (Rivera and Obón 1995).

***Ruta graveolens* L. (Rutaceae). common rue.**

In North America, this species was mixed with tobacco (*Nicotiana* spp.) and smoked as a sedative to treat neuralgia (Krochmal and

Krochmal 1973). The Spanish immigrants of New Mexico inhaled the smoke of burning oil and tobacco leaves as both an emmenagogue and abortifacient (Curtin 1965).

***Ruta* spp. (Rutaceae). rue.**

In Morocco, rue was often mixed with unspecified incense materials or rosemary and was burned to produce smoke that countered the effects of the evil eye. It reportedly could also cure the bewitched (Blazquez Miguel 1985; Villar Pérez et al. 1987; Navarro López 1994).

***Ryania mansoana* Eichler (Flacoourtiaceae). silent killer.**

In parts of Brazil, the smoke was considered fatal if inhaled, hence the local name for the plant, *mata calado* ("silent killer") (von Reis and Lipp 1982).

***Saccharum munja* Roxb. (Poaceae). munj sweetcane.**

The roots of this species were burned in parts of India to fumigate women after childbirth (Chopra et al. 1956). The smoke was also considered useful for treating scalds and burns.

***Sacoglottis ceratocarpa* Ducke (Humiriaceae). Sacoglottis.**

Smoke from burning bark was inhaled for the relief of asthma by the Makunas of the Amazon (Schultes 1979; Schultes and Raffauf 1990).

***Salix humilis* Muhl. (Salicaceae). upland willow.**

The Penobscot of North America smoked the bark to relieve asthma (Speck 1917). The Montagnais and other northern tribes smoked it as a substitute for tobacco (*Nicotiana* spp.) (Speck 1917). The Parry Island Ojibwa also smoked the bark when tobacco was scarce (Jenness 1935).

***Salix lucida* Muhl. (Salicaceae). shining willow.**

Various parts of this plant were smoked by Native Americans. The Penobscot of North America smoked the bark to relieve asthma (Speck 1917), the Montagnais smoked the bark as a tobacco (*Nicotiana* spp.) substitute (Speck 1917), and the Ojibwa toasted flaked bark and added it to their kinnikinnick smoking mixtures (Smith 1932).

Salix lucida

***Salix scouleriana* Barratt in Hook. (Salicaceae). scouler's willow.**

The wood was burned by the Shuswap of North America who used the smoke to preserve salmon (Palmer 1975).

***Salix* sp. (Salicaceae). willow.**

The Hungarian name for willows is *fuzfa*. The bark of an unspecified species was burned and used as a fumigant to help heal the wounds of castrated calves (Vajkai 1943).

***Salix suberrata* Willd. (Salicaceae). willow.**

According to ancient Egyptian texts, this species was burned with other unspecified ingredients to produce smoke that was inhaled for toothache relief (Manniche 1989).

***Salvadora angustifolia* Turrill (Salvadoraceae). mundamuka.**

The smoke of burning leaves was inhaled to stop nosebleeds in Venda, South Africa (Arnold and Gulumian 1984).

***Salvadora australis* Schweik (Salvadoraceae). narrow leaved mustard tree.**

The Venda of South Africa burned the leaves and inhaled the smoke to stop nosebleeds (Arnold and Gulumian 1984).

***Salvadora persica* L. (Salvadoraceae). mustard tree.**

Smoke from burning this species was used for two purposes in northern India (Shah 1982). The leaves were dried, powdered, and then smoked with tobacco (*Nicotiana* sp.) to treat asthma and coughs. The wood was burned to generate smoke that repelled mosquitoes.

***Salvia apiana* Jeps. (Lamiaceae). white sage.**

This species was often used in traditional Chumash healing practices, which date back at least 13,000 years in California (Adams and Garcia 2005). In more recent times, healers prepared smudges, at which time all those who were present had to pray. The smoke from the smudge was said to bring the prayers to God, inviting Him to participate in the healing process. Traditional Chumash healers started their treatments with different preparations of white sage. Elsewhere in California, the leaves were burned in the sweat baths of the Cahuilla, who inhaled the smoke for treating colds (Bean and Saubel 1972). The nearby Diegueno, also of California, burned the leaves and used the smoke as a fumigant for a sick person's house (Romero 1954).

***Salvia divinorum* Epling & Játiva (Lamiaceae). sage of the diviners.**

This member of the mint family was extensively used as an entheogen (psychoactive substance that causes one to be in god) by the shamans of the Mazatec of the Sierra Mazateca in Oaxaca, Mexico (Marushia et al. 2002). The shamans smoked the dried leaves in a pipe. Since its introduction to the scientific community in the 1950s, this species has been researched extensively. Its psychoactive properties are due to a neoclerodane diterpene called Salvorin A. This is one of the most hallucinogenic natural products known. It has been suggested that young Mexican and Swiss people may be smoking the plant recreationally as a marijuana (*Cannabis sativa* L.) substitute (Giroud et al. 2000).

Salvia divinorum

***Salvia officinalis* L. (Lamiaceae). sage.**

Dried leaves were smoked in Nepal to relieve asthma (Manandhar 2002).

Salvia officinalis

***Sambucus ebulus* L. (Caprifoliaceae). dwarf elderberry.**

In northwestern Anatolia, Turkey, the leaves were burned on hot embers, and the smoke was used to fumigate the wounded areas of bulls that had been castrated (Yeşilada et al. 1999).

***Sambucus nigra* L. (Caprifoliaceae). European black elderberry.**

Smoke from several parts of this plant was employed as a fumigant to treat a variety of illnesses in the Catalonia Districts (Iberian Peninsula) of Pallars Jussà and Pallars Sobirà (Pyrenees) and in the Montseny Massif (Vallès et al. 2004). In the Ubage Valley of France, the flowers of this species, when burned, produced smoke that was used as a fumigant to treat ophthalmia (Novaretti and Lemordant 1990). Aberëshë Albanians living in Italy's northern Basilicata region, collected the stems, dried

them, and then smoked them to treat toothache (Pieroni et al. 2002). The Aberëshë name for the species is *shtog*. These people believed that inhaling the smoke of burning wood could also cause migraines. According to Celtic folklore, the same smoke was said to draw evil and brought bad luck with it (Asala 1998).

***Sanchezia* spp. (Actinidiaceae). Sanchezia.**

The leaves of several species of *Sanchezia,* many of which were reported to be hallucinogenic, were smoked by the Yarina Cocha of Peru (Maxwell 1961).

***Santalum album* L. (Santalaceae). sandalwood.**

Sandalwood was and still is highly prized in India, Egypt, Greece, and Italy for incense and perfume purposes. The sawdust of this species was also burned by the people of Java, Indonesia, and by various groups in eastern India as incense. In China, the wood was burned for this purpose, too (Uphof 1968; Sangat-Roemantyo 1990). There is no doubt that it may have been used as incense by various other groups.

Santalum album

***Santalum lanceolatum* R. Br. (Santalaceae). plumbush.**

Some Native Australian tribes fumigated themselves with the smoke of burning leaves to give them strength and endurance during long trips (Webb 1969). In the Northern Territory of Australia, other Native Australian tribes produced the smoke for babies to inhale because it was said to strengthen and calm them (Barr 1993). The smoke was also considered useful for driving away mosquitoes (Cribb and Cribb 1981).

***Sapium biloculare* (S. Wats.) Pax (Euphorbiaceae). jumpingbean tree.**

The smoke of the wood, when burned, is an irritant that will cause sore or red eyes and swollen eyelids (Peattie and Landacre 1991).

***Saprosma foetens* K. Schum. (Rubiaceae). peenari.**

Members of the hill tribes of southern India's Kerala State burned the wood of this species, known locally as *peenari,* to give off fumes that were inhaled to cure vomiting and diarrhea in children (Kumar et al. 2000).

***Sarcobatus vermiculatus* (Hook.) Torr. In Emory (Chenopodiaceae). greasewood.**

Until more recent times, the Ute Mountain Ute of Colorado burned this species to perform a final smoking of animal hides that were used for making clothes, bags, and tepee covers (Dunmire and Tierney 1997). The smoke usually changed the color of the hide.

***Sarcocephalus latifolius* (Sm.) Bruce (Rubiaceae). country fig.**

In Bulamogi County, Uganda, dried leaves were smoked to keep spirits at bay (Tabuti et al. 2003).

***Sarcostemma australe* R.Br. (Asclepiadaceae). caustic vine.**

Smoke from burning the white sap produced by *S. australe* was used by the Pitjantjatjara of Australia for general medicinal purposes (Latz 1995).

***Sauropus quadrangularis* Müll. Arg. (Euphorbiaceae). Sauropus.**

The smoke of burning dried leaves was inhaled in India (Chopra et al. 1956) and Nepal (Manandhar 2002) as a remedy for tonsillitis. This treatment was also recommended by Indian Ayurvedic medicine (Lewis and Elvin-Lewis 2003).

***Saussurea lappa* (Decne.) C. B. Clarke (Asteraceae). costus root.**

This species was sometimes smoked as an opium substitute in Tibet (Tsarong 1986). In India's Lahoul Valley (northwestern Himalayas), powdered root material was burned as incense (Koerlz 1979). This species was also a key ingredient in two concoctions of plants and animals that, when burned to produce smoke, were reported to cause blindness in one's enemies or killed animals. This was according to book 4, chapter 1, topic 177, of the ancient fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya* (Sensarma 1998) (see recipes 2 and 3 under *Asparagus racemosus* Willd.).

***Saxifraga stolonifera* Meerb. (Saxifragraceae). creeping saxifrage.**

In China, smoke from burning dried plant material was used as a fumigant to treat hemorrhoids (Bliss 1973; Perry 1980).

***Scaevola spinescens* R. Br. (Goodeniaceae). prickly fanflower.**

Native Australians burned the complete plant to produce fumes that were inhaled to treat colds (Reid and Betts 1977).

***Sceletium expansum* L. Bolus (Aizoaceae). kanna.**

Dutch explorers reported that the Hottentot of South Africa, especially in the hinterlands, smoked the roots and leaves of this species for their psychoactive properties (Schultes et al. 2001). The practice remained in use until at least 2001.

***Sceletium tortuosum* N. E. Br. (Aizoaceae). kanna.**

This closely related species of *Sceletium expansum* L. Bolus was also reportedly smoked for its psychoactive properties by the Hottentot of South Africa (Schultes et al. 2001).

***Schima wallichii* Choisy (Theaceae). Chinese guger tree.**

The Lahu villagers of northern Thailand burned this species because its smoke was said to be offensive to the eyes of the evil weretiger, keeping it at bay (Anderson 1993).

***Schinopsis cornuta* Loesn. (Anacardiaceae). Schinopsis.**

The Izoceño-Guaraní of Bolivia burned the leaves of this species over hot charcoal and inhaled the smoke to stop hemorrhaging of the nose (Bourdy et al. 2004).

***Schinus latifolius* Engl. (Anacardiaceae). mulle.**

A mixture of tobacco (*Nicotiana* spp.) and unspecified parts of this species was smoked for pleasure by the Mapuche of south-central Chile (Houghton and Manby 1985).

***Schmaltzia bakeri* Greene (Anacardiaceae). three-leaved sumac.**

Various Native Americans smoked the leaves of this species with those of tobacco (*Nicotiana* spp.) (Uphof 1968; Lewis and Elvin-Lewis 2003). These included the Keresan (White 1945) and the Kiowa (Vestal and Schultes 1939). Moerman (1998) notes that the species actually used by the Keresan may have been *Rhus trilobata* Nutt. ex Torr. & A. Gray, and the Kiowa may have used *Rhus trilobata* Nutt. ex Torr. & A. Gray var. *trilobata*.

***Schotia brachypetala* Sond. (Fabaceae). weeping boer bean.**

In Zimbabwe, the smoke of burning leaves of weeping boer bean was inhaled to stop nosebleeds (Gelfand et al. 1985).

***Schwenkia americana* L. (Solanaceae). Kamugobe.**

The leaves of this plant were smoked by the people of Bulamogi County, Uganda, to help keep spirits at bay (Tabuti et al. 2003).

***Scoparia dulcis* L. (Scrophulariaceae). licorice weed.**

The leaves of licorice weed were smoked in Guyana to treat respiratory disorders (Defilipps et al. 2004).

***Scopolia carniolica* Jacq. (Solanaceae). nightshade.**

This species was used as an aphrodisiac and psychoactive love potion in both Latvia and Lithuania. The plant, when dried, was smoked alone or mixed with other herbs (Schultes et al. 2001).

***Scopolia stramonifolia* (Roxb.) N. P. Balakr. (Solanaceae). scopolia.**

In Nepal, the smoke generated by burning the seeds of scopolia was inhaled through the nose to treat wounds inside the nasal cavity (Manandhar 2002).

***Securidaca longepedunculata* Fresen. (Polygalaceae). amhara.**

In Mali, West Africa, the roots of this species were mixed with the roots and stems of *Guieria senegalensis* J. F. Gmel. and burned to produce smoke that was inhaled to heal wounds caused by Satan (Inngjerdingen et al. 2004). In South Africa, the smoke of burning roots was inhaled to treat flatulence (Neuwinger 1994).

***Selaginella caffrorum* (Milde) Hieron. (Selaginellaceae). spikemoss.**

The Sotho of South Africa mixed parts of this plant with whole *Lycopodium clavatum* L. and smoked the mixture to treat headaches (Jacot Guillarmod 1971).

***Selaginella scandens* (P. Beauv.) Spring (Selaginellaceae). climbing spikemoss.**

The leaves of this plant were burned to produce smoke that was used as a fumigant to repel ticks (Secoy and Smith 1983).

***Selaginella wightii* Hieron. (Selaginellaceae). Wight's spikemoss.**

In parts of Africa, unspecified parts of this moss were sometimes smoked with parts of *Lycopodium clavatum* L. to treat headaches (Jayaweera 1982b).

***Selinum candolli* DC. (Apiaceae). mathosal.**

Members of India's Gabbi tribe (Himachal Pradesh State) burned the roots of mathosal to fumigate their dwellings to kill and repel insects and to purify the air (Singh and Kumar 2000). The roots of this species were also burned as incense by the Gabbi tribe (Singh and Kumar 2000) and by the people of Nepal (Manandhar 2002).

***Selinum tenuifolium* Wall. (Apiaceae). Cambridge milk parsley.**

The leaves of this plant were burned as incense during the religious ceremonies of the Himachal Hill people of India (Sharma and Rana 2000).

***Selinum wallichianum* (DC.) Raiz. & Saxena (Apiaceae). cow parsley.**

The Kumaon of India used powdered roots of cow parsley to prepare incense sticks (Shah and Joshi 1971). The natives of the Sikkim Himalayas, also of India, burned the roots for smoke that reportedly drove away evil spirits (Pandey 1991).

***Semecarpus anacardium* L. f. (Anacardiaceae). marking nut tree.**

Juice obtained from unspecified parts of this species was burned along with unspecified parts of *Asparagus racemosus* Willd.; the roots, bark, leaves, flowers, and fruits of *Saussurea lappa* (Decne.) C. B. Clarke; and unspecified parts of *Vernonia anthelmintica* Willd. to produce smoke that was used to deliberately kill animals according to the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.) (Sensarma 1998). The mixture also required parts of several animal species.

***Semecarpus australiensis* Engl. (Anacardiaceae). tar tree.**

Members of some Native Australian tribes burned the nuts of this species and used the fumes to help slough rectal piles (Maiden 1889a).

***Senecio graveolens* Wedd. (Asteraceae). strong-scented groundsel.**

The leaves and stems were burned as incense by the pre-Altiplanic people of Chile (Aldunate et al. 1983).

***Senecio* sp. (Asteraceae). groundsel.**

The Navajo living near the Canyon de Chelly in Arizona smoked groundsel during several of their ceremonies (Dunmire and Tierney 1997).

***Senna artemisioides* (DC.) Randell ssp. *filifolia* Randell. (Fabaceae). punty bush.**

Australia's Warlpiri used the leaves for a smoke treatment for babies (Latz 1995).

***Senna occidentalis* (L.) Link (Fabaceae). septic weed.**

In the rural villages of the Oio region of Guinea-Bissau, West Africa, the villagers burned freshly collected plants to produce smoke that was used to drive away mosquitoes (Pålsson and Jaenson 1999b).

***Senna singueana* (Delile) Lock (Fabaceae). wild cassia.**

To help keep spirits at bay, the people of Bulamogi County, Uganda, smoked the roots of this species (Tabuti et al. 2003). People who had become lost smoked the leaves to help find their way home.

***Senra incana* Cav. (Malvaceae). Senra.**

In the Dhofar region of southern Oman, shavings from the stem of this *Senra* species were smoked for pleasure and relaxation, especially when tobacco (*Nicotiana* spp.) was not available (Miller and Morris 1988).

Senna occidentalis

***Sesamothamnus busseanus* Engl. (Pedaliaceae). Iallaafto kôrm f.**

This species was used as a milk container fumigant and cleanser by the Borana of Ethiopia and the Gabbra of Marsabit District, Kenya (Heine and Brenzinger 1988).

***Setaria poiretiana* (Schult.) Kunth (Poaceae). brittlegrass.**

In the Kabale District of the Buganda kingdom of Africa, members of the Bakiga tribe smoked unspecified parts of this plant in cigarettes that were considered useful for the relief of asthma (Hamill 2001).

***Shorea leprosula* Miq. (Dipterocarpaceae). meranti.**

The sawdust of this species was used for the preparation of incense in Java, Indonesia (Sangat-Roemantyo 1990).

***Shorea robusta* Gaertn. (Dipterocarpaceae). saul tree.**

Resin obtained from this species was burned as a fumigant to repel insects in Sidhi District of Madhya Pradesh, India (Saini 2004), and in the Santhal villages of Birbhum, West Bengal, India (Banerjee 2000). Members of the Jatapus and Savaras tribes of India's Eastern Ghats area (Andhra Pradesh State) inhaled the smoke of burning resin for the treatment of chicken pox (Rama Rao and Henry 1996). The aromatic resin, known sometimes as *dammar*, was burned as incense both in the Indian Himalayas and in Pakistan (Uphof 1968; Usher 1974). It was also used in parts of India to fumigate sickrooms (Dhiman 2003). According to the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), the resin was one of several ingredients in a concoction that was burned to produce smoke that was believed to cause blindness to one's enemies (recipe 1 under *Asparagus racemosus* Willd.) (Sensarma 1998). The Indian name for this species is *sara*.

***Sida acuta* Burm. f. (Malvaceae). axocatzin.**

Along the coastal Gulf regions of Mexico, this species was smoked as a stimulant and cannabis substitute (Schultes et al. 2001).

***Sida cordifolia* L. (Malvaceae). country mallow.**

According to the Ayurveda of India, parts of this plant were dried in the sun and then soaked with ghee before being smoked to relieve asthma (Mishra 2003).

***Sida rhombifolia* L (Malvaceae). common sida.**

Like *Sida acuta* Burm. f., this species was smoked as a stimulant and cannabis substitute along the coastal Gulf regions of Mexico (Schultes et al. 2001), where it is known as *escobilla*.

***Silene conoidea* L. (Caryophyllaceae). catch fly.**

In India, this species was used as a fumigant for unspecified purposes (Kapur 1996b; Sood and Thakur 2004).

***Silene inflata* Sm. (Caryophyllaceae). maiden's tears.**

This species was used as a general fumigant in India's Bhaderwah Hills (Jammu Province) (Kapur 1996b).

***Silene italica* (L.) Pers. (Caryophyllaceae). Italian catchfly.**

Italian catchfly was used in central Italy, where the seeds were burned to produce smoke that was considered useful as a mouth disinfectant (Leporatti and Pavesi 1990). Patients would put their mouth over the smoke to inhale it.

***Silvaea pachyphylla* Phil. (Portulacaceae). Silvaea.**

The leaves were considered useful for burning as incense by the pre-Altiplanic community of Chile (Aldunate et al. 1983).

***Sinapsis alba* L. (Brassicaceae). mustard.**

In Hungary, where this plant is known as *mustár,* the seeds were burned to generate smoke that was inhaled to relieve earache (Babulka and Pataki 1997).

***Sium suave* Walt. (Apiaceae). water parsnip.**

The seeds of this species were smoked by the Flambeau Ojibwa of North America. They believed that it could drive away and blind the evil spirit Sokênau, who it was claimed could steal one's hunting luck (Smith 1932).

***Skimmia laureola* (DC.) Decne. (Rutaceae). neera.**

In the Ayuba National Park District of Abbottabad, Pakistan, smoke from burning leaves was inhaled to clear nasal passages, treat colds, and relieve headaches (Gilani et al. 2001). In other parts of Pakistan, the smoke was used to drive away evil ghosts (Khan et al. 2003) and possibly to treat smallpox (Saeed et al. 2004). The Kumaon of India crushed dried leaves as part of the preparation of incense materials (Shah and Joshi 1971).

***Smilacina trifolia* (L.) Desf. (Liliaceae). threeleaf false lily of the valley.**

The roots were burned on a red-hot stone to produce fumes that were inhaled by the Ojibwa of North America to relieve headache (Hoffman 1891). The Menonmini, also of North America, soaked the roots after they were ground and then placed them on a hot stove. The fumes were inhaled for relieving catarrh (Smith 1923). The Meskwaki used the smudge to calm crying children or to treat severe illness (Smith 1928). The roots were burned and smudged for treating insanity. The Potawatomi used the root smudge for reviving comatose people (Smith 1933). They fanned the fumes and then directed them up the patient's nostrils. This species may have recently been renamed *Maianthemum trifolium* (L.) Sloboda.

***Smilax glyciphylla* Sm. (Smilacaceae). native sarsaparilla.**

This species may have been smoked in the West Indies for the relief of asthma (Cribb and Cribb 1981).

***Smilax ornata* Lem. (Smilacaceae). Jamaican sarsaparilla.**

In Europe, the smoke of burning Jamaican sarsaparilla was recommended for the relief of asthma (Grieve 1971).

***Socratea exorrhiza* (Mart.) H. Wendl. (Arecaceae). huacrapona.**

Smoke from burning fruit was used to treat venereal diseases and for urinary tract disorders by the people of Guyana (Defilipps et al. 2004).

***Solanecio angulatus* (Vahl) C. Jeffrey (Asteraceae). Izimya,**

The leaves were smoked to keep spirits at bay in Bulamogi County, Uganda (Tabuti et al. 2003).

***Solanum aculeatissimum* Jacq. (Solanaceae). apple of Sodom.**

The Tamang tribe of Nepal fried the fruits of this species and then smoked them to relieve headache (Anonymous 1948–1976). Elsewhere in Nepal, the fruits were smoked for toothache (Manandhar 1991).

***Solanum anguivi* Lam. (Solanaceae). Madagascar potato.**

In the Dungarpur District of India's Rajasthan State, where this species is known as *bhui-ringna,* the seeds were thrown into fires to generate smoke that was inhaled to cure infected teeth (Singh and Pandey 1998). The Tamang tribe of Nepal smoked the ripe fruits for the relief of toothache (Watt 1893).

***Solanum ciliatum* Lam. (Solanaceae). fringed-hair nightshade.**

In unspecified parts of India, smoke generated by burning parts of this plant was inhaled to treat ulcers inside the nose (Singh et al. 1983).

***Solanum inaequilaterale* Merr. (Solanaceae). Solanum.**

The leaves of this species of *Solanum* were smoked in the Philippines for unspecified purposes (Lewis and Elvin-Lewis 2003).

***Solanum incanum* L. (Solanaceae). batâg.**

In the town of Turbat, east of Baluchistan Province, Pakistan, dry ripe seeds were smoldered over hot coals by the people, who inhaled the smoke to cure worm infections of the gums (Goodman and Ghafoor 1992).

***Solanum indicum* L. (Solanaceae). Indian sunplant.**

Several Malaysian groups inhaled the smoke of roasting roots for the treatment of toothache (van Duong 1993).

***Solanum khasianum* C. B. Clarke var. *chatterjeeanum* Sen Gupta (Solanaceae). athlo.**

At the far northeastern end of the Himalayan ranges in India's Mizoram State, the dried fruits and seeds of this species were burned to generate smoke that was inhaled through a bamboo or papaya leafstalk to eliminate toothworms in the mouth (Lalramnghinglova 2003). *Athlo* is the local name for this species.

Solanum incanum

***Solanum melongena* L. (Solanaceae). eggplant.**

In Iran, the smoke of burning eggplant fruits, known locally as *bademjam,* was used as an external fumigant to treat hemorrhoids (Mohagheghzadeh et al. 2006).

***Solanum myriacanthum* Dunal. (Solanaceae). Himalayan nightshade.**

Seed smoke was used as a fumigant to kill germs in the mouth of people in India's northeastern state of Assam (Sharma, U. K. 2004).

***Solanum nigrum* L. (Solanaceae). black nightshade.**

Powdered fruit material was smoked to cure pharyngeal infection and tonsil swellings in the Narayanpatna Hills of Koraput District, Orissa State, India (Dash and Misra 2000). The Costanoan of North America smoked the leaves for toothache (Bocek 1984).

***Solanum renschii* Vatke (Solanaceae). mutongatongu.**

The Borana of Ethiopia and the Gabbra of Kenya fumigated and cleansed their containers using smoke produced by burning this species (Heine and Brenzinger 1988). *Mutongatongu* is the eastern Kenyan name for the species.

***Solanum surattense* Burm. f. (Solanaceae). Surattense nightshade.**

In the tribal dominated Mewar region of Rajasthan State, India, this plant was used to treat piles (Katewa et al. 2004). The affected part was fumigated. According to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.), this species, when burned together with *Asparagus racemosus* Willd., *Datura metel* L., *Ipomoea paniculata* R. Br., *Shorea robusta* Burm. f., as well as two unspecified insects and one unspecified fish, can produce smoke that causes blindness in one's enemies (Sensarma 1998). In Nepal, the dried, powdered fruit was smoked to relieve toothache (Manandhar 2002).

***Solanum trilobatum* L. (Solanaceae). nightshade sparrow's brinjal.**

In India, dried leaves and flowers were burned as incense to cure colds (Madhaven and Balu 2000).

***Solanum viarum* Dunal. (Solanaceae). tropical soda apple.**

The Tharus of the Keri District of India's Uttar Pradesh State smoked the dried fruits of this species for the relief of toothache (Maheshwari et al. 1981).

***Solanum violaceum* Ortega (Solanaceae). Asian nightshade.**

Approximately 100 g of the seeds were fried with 50 ml of mustard oil and then smoked to relieve toothache by people of the Jajpur District of India's Orissa State (Satapathy and Brahmam 2000).

***Solanum xanthocarpum* Schrad. & Wendl. var. *jacquini* Thw. (Solanaceae). yellow-berried nightshade.**

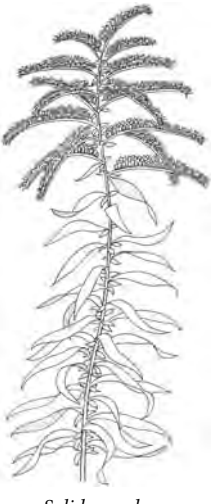
The fumes of burning seeds were considered useful in Sri Lanka for relieving toothache (Jayaweera 1982b). The species has many local common names, including *katuwel-batu* and *kandangattari*.

***Solidago graminifolia* (L.) Salisb. (Asteraceae). fragrant goldenrod.**

The Flambeau Ojibwa of North America used the flowers in mixtures of plants that were smoked to simulate the odor of deer hooves (Smith 1932). Known as blue lizard tobacco by the Navajo, also of North America, the flowers were dried and smoked for pleasure (Ross 2002).

***Solidago odora* Ait. (Asteraceae). anise-scented goldenrod.**

The Ojibwa of North America mixed the flowers of this species to their hunting medicine, which they smoked to attract deer. Reportedly, it simulated the odor of deer hooves (Smith 1932).



Solidago odora

***Solidago* spp. (Asteraceae). goldenrods.**

The flowers and leaves of plants of this commonly occurring North American genus frequently were gathered and burned by the Ojibwa of North America to produce smoke that was inhaled for medicinal purposes and for help with hunting deer (Kavasch 1979).

***Solidago ulmifolia* Muhl. ex Willd. (Asteraceae). elmleaf goldenrod.**

The Meskwaki of North America considered the smoke of this plant useful for reviving an unconscious person (Smith 1928).

***Sorbus aucuparia* L. (Rosaceae). European mountain ash.**

In Limerick, Ireland, animals were forced to inhale the smoke of burning wood for unspecified veterinary purposes (Allen and Hatfield 2004).

***Sorghum* sp. (Poaceae). sorghum.**

In parts of East Africa, where the Bantu language of Swahili is common and where plants of this genus are known as *kipepe,* the fresh leaves of an unspecified species of *Sorghum* was used as a general fumigant (Heine and Legére 1995).

***Spartium junceum* L. (Fabaceae). Spanish broom.**

The smoke of burning branches, which was traditionally produced on Christmas Eve in Tuscany and elsewhere in Italy, was used to drive away the evil eye (Pieroni and Giusti 2002). In Ecuador, dried flowers were smoked to relieve asthma (Joyal 1987).

Figure 21. One of the more common European uses for *Spartium junceum* was as brooms for sweeping. In parts of the world, the bright yellow flowers of the species were smoked for their psychotropic effects.

***Spathiphyllum candicans* Poepp. and Endl. (Araceae). peace lily.**

Peruvian natives used the leaves to flavor tobacco (*Nicotiana* spp.) (Uphof 1968).

***Spathiphyllum cannifolium* Schott. (Araceae). peace lily.**

Dried leaves were used in tropical South America to flavor tobacco (*Nicotiana* spp.) (Uphof 1968).

***Sphaeralcea* sp. (Malvaceae). globemallow.**

The Navajo of North America smoked the leaves of this species like tobacco (*Nicotiana* spp.) (Dunmire and Tierney 1997).

***Spiranthes aurantiaca* (Llave & Lex.) Hemsl. (Orchidaceae). ladies' tresses.**

In the Mexican states of Jalisco and Nayarit, the Huichol would often add the flowers of this plant to tobacco (*Nicotiana* spp.) and smoked the mixture during the Peyote Pilgrimage (Bauml 1994).

***Spirospermum penduliflorum* DC. (Menispermaceae). lavaravina.**

In Madagascar, the leaves were smoked in cigarette form to stop vomiting blood (Boiteau and Allorge-Boiteau 2000). *Lavaravina* is the Madagascan name for this species.

***Spirostachys africana* Sond. (Euphorbiaceae). tamboti.**

Known as *muonze* in Venda, South Africa, the bark from the wood of this species was burned, and the smoke was inhaled to treat headaches, nose and gum bleeding, colds, coughs, flu, and fever (Arnold and Gulumian 1984).

***Spondius mombin* L. (Anacardiaceae). hog plum.**

In the Caribbean island of Dominica, the kernels of the fruits, often known as *monben*, were burned to produce fumes that were considered ideal for curing swollen or inflamed joints (Hodge and Taylor 1957).

***Stachys annua* L. (Lamiaceae). hedge nettle.**

This species is known as *tarlóvirág* and *tisztesfu* in Hungary, where smoke from burning aerial parts was used as a fumigant to treat mastitis in a variety of different animals (Kóczián and Szabó 1990).

***Stachytarpheta cayennensis* (Rich.) Vahl. (Verbenaceae). vervain.**

This plant was considered a sacred herb by the ancient Maya, who used it to ward off evil influences (Arvigo and Balick 1993). The leaves are still burned as incense for this purpose in Belize.

***Stemona tuberosa* Lour. (Stemonaceae). bch bé.**

This plant was employed as a fumigant to repel insects in Vietnam, Cambodia, and Laos (van Duong 1993). *Bch bé* is the Vietnamese name for the plant.

***Stenocereus thurberi* (Engelm.) Buxb. (Cactaceae). organ pipe.**

The Seri of Mexico and parts of Arizona considered dried organ pipe wood ideal for smoking out bees (Felger and Moser 1985). The dried stems, when burned, produce a thick, black smoke that the Seri used for smoke signals (Quinn and Quinn 1965; Sheldon 1979).

***Stephania hernandiflora* Walp. (Menispermaceae). Stephania.**

This species is listed in the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya* as one of several plant ingredients in a mixture burned to produce smoke to blind one's enemies (see recipe 2 under *Asparagus racemosus* Willd.) (Sensarma 1998).

***Stereospermum kunthianum* Cham. (Bignoniaceae). pink jacaranda.**

Around the Tenkodogo area of Burkina Faso, people considered the smoke of this species poisonous, making them feel faint when they inhaled it (Kéré 1998). In the Sudan, the smoke was believed to be useful for treating leprosy (Brown and Massey 1929). There are many common local names for this species, including *sansami*. It is also sometimes referred to as the "tulip tree."

***Streblus asper* Lour. (Moraceae). toothbrush tree.**

The wood of this species was cut into small pieces and then added to tobacco (*Nicotiana* spp.) to make Burmese cheroots, which were smoked for pleasure by the people of Andaman Islands, India (Dagar and Dagar 1999).

***Streblus taxoides* Kurz. (Moraceae). Streblus.**

The bark of this streblus was smoked to treat head colds in India (Chopra et al. 1969).

***Streptoglossa odora* (F.Muell.) Dunlop (Asteraceae). stinkweed.**

Indigenous Australians of the Northern Territory inhaled the smoke of burning leaves to treat respiratory infections (Barr 1993).

***Streptogyna americana* C. E. Hubb. (Poaceae). ki-kweweh-nah-ru.**

The whole plant was burned for smoke that reportedly was useful as a pediatric aid in Suriname (Defilipps et al. 2004).

***Striga gesnerioides* Vatke ex Engl. (Scrophulariaceae). purple witchweed.**

In Namibia, people pounded the roots and then threw them on glowing embers to give off smoke that was used as a fumigant to relieve pain all over the body (von Koenen 2001).

***Strychnos phaeotricha* Gilg. (Loganiaceae). Strychnos.**

In the Democratic Republic of Congo, the seeds of this species were burned in a calabash to produce smoke that children with respiratory diseases were forced to inhale (Disengomoka et al. 1983).

***Styrax argentum* Presl. (Styracaceae). silver styrax.**

This species was used in Mexico, where gum tapped from the trunks was burned for its aromatic smoke (Usher 1974).

***Styrax benzoin* Dryand. (Styracaceae). styrax.**

The people of Java, Indonesia, burned the latex or the sap for incense purposes (Sangat-Roemantyo 1990).

***Styrax camporum* Pohl. (Styracaceae). styrax.**

The resin from the trunk of styrax trees was burned as incense in an unspecified part of the world (Usher 1974).

***Styrax ferrugineum* Nees & Mart. (Styracaceae). styrax.**

The stems and branches of this species were harvested in Brazil and in Paraguay for the preparation of incense materials (Uphof 1968).

***Styrax officinalis* L. (Styracaceae). styrax.**

The stem and branches were burned as incense in Cyprus, where the plant is known as *steratzia* (Georgiades 1987b).

***Styrax ovatus* (Ruiz & Pav.) DC. (Styracaceae). styrax.**

The resins were traditionally burned in the Americas as incense (Rätsch 2004).

***Styrax tessmannii* Perkins (Styracaceae). styrax.**

The resins were traditionally burned in the Americas as incense (Rätsch 2004). The fumes may be psychoactive.

***Styrax tonkinensis* Craib ex Hartwich (Styracaceae). Siam benzoin.**

This species was considered useful in Malaysia, where the stem resin was burned as incense (Uphof 1968; Usher 1974).

***Styrax weberbaueri* Perkins (Styracaceae). styrax.**

The resins were traditionally burned in the Americas as incense (Rätsch 2004).

***Suaeda vermiculata* Forssk. ex. J. F. Gmel. (Chenopodiaceae). suwwâd.**

The green parts of this plant were burned in Kuwait for smoke that was inhaled to treat asthma (Al-Kalifa and Sharkas 1984). The stems were smoked for the same purpose elsewhere in the Arab world (Ghazanfar 1994).

***Sutera* sp. (Scrophulariaceae). bacopa.**

The Sotho of South Africa burned unspecified parts of this plant to produce smoke for treating mental patients (Watt and Breyer-Brandwijk 1962).

***Swertia chirata* C. B. Clarke. (Gentianaceae). Kirata-tikta.**

In Iran, the stems were, according to Avicenna, smoked to relieve coughs (Mohagheghzadeh et al. 2006).

***Symphoricarpos* sp. (Caprifoliaceae). snowberry.**

The Southern Paiute of the United States once smoked the leaves of a snowberry species for unspecified purposes (Dunmire and Tierney 1997).

***Symphyotrichum lanceolatum* (Willd.) Nesom ssp. *hesperium* (Gray) Nesom var. hesperium.**

The Zuñi of New Mexico crushed the plant in their hands, rolled it into cigarettes bound by corn husks, and smoked it to stop nosebleeds (Stevenson 1909). The local name for the plant was *kw'minně lo kĭana*, or "gray root." This species was reported as *Aster hesperius* A. Gray in original texts.

***Syzygium guineense* DC. (Myrtaceae). woodland waterberry.**

The Gabbra of Kenya burned the bark, wood, and root as incense (Heine and Brenzinger 1988).

***Tabernaemontana divaricata* (L.) R. Br. ex Roem. & J. A. Schult. (Apocynaceae). pinwheel flower.**

The wood of the pinwheel flower was burned in various parts of India for incense purposes (Watt 1893). This species was considered sacred there (Dhiman 2003).

***Tabernaemontana elegans* Stapf (Apocynaceae). toad tree.**

This species was used to treat menorrhagia in Venda, South Africa. The vulva of affected women was exposed to smoke of burning roots. The smoke was also inhaled under a blanket for the relief of headaches (Arnold and Gulumian 1984).

***Taenidia integerrima* Drude. (Apiaceae). yellow pimpernel.**

The Flambeau Ojibwa of North America believed that smoking the seeds in a pipe brought them good luck when hunting (Smith 1932).

***Tagetes lucida* Cav. (Asteraceae). sweet marigold.**

The ancient Aztec of Mexico used unspecified parts of this plant to produce smoke that dulled their prisoners prior to execution (Neher 1968). The Aztecs also used it during religious ceremonies (Gates 1939). Among the Huichol of Mexico, this plant was mixed with *Nicotiana rustica* L. and smoked to produce hallucinogenic effects (Siegel et al. 1977). The mixture was often smoked while drinking a fermented beer made from maize. This was said to induce clearer visions (Schultes et al. 2001). It was also burned in houses as a disinfectant (Martínez 1969). In northwestern parts of the Amazon, this species was mixed with the leaves of *Nicotiana rustica* L. and smoked for unspecified purposes (Schultes 1979).

Tagetes lucida

***Tagetes minuta* L. (Asteraceae). wild marigold.**

Plant material from the entire plant was burned in many Zimbabwean communities for its smoke, which was considered useful for repelling mosquitoes (Lukwa et al. 1999). The leaves were mixed with those of several other species and burned for smoke that was inhaled to stop dizziness and to relieve headaches in Venda, South Africa (Arnold and Gulumian 1984). The smoke was considered useful for treating certain mental illnesses. For this purpose, the smoke was inhaled twice a day. The Mukogodo Maasai of Laikipia District of northern Kenya burned the twigs to ward off fleas and other pests (Brenzinger et al. 1994).

***Tagetes patula* L. (Asteraceae). French marigold.**

Known as *bársonyvirág* in Hungary, the aerial parts of this plant were burned to generate smoke that was inhaled to treat wounds of the nose (Kóczián and Szabó 1990).

***Tamarix gallica* L. (Tamaricaceae). French tamarisk.**

According to Avicenna, smoke from burning fruit was used in Iran as a fumigant to treat general dermatological disorders (Mohagheghzadeh et al. 2006).

***Tamarix stricta* Boiss. (Tamaricaceae). gaz.**

Domestic animals belonging to the people of the Tarbat area in southern Pakistan were forced to inhale the smoke produced by burning the old portion of bark that

had been peeled off the lower trunk of this tree (Goodman and Ghafoor 1992). This was said to treat châllô, a weakness and pain occurring in limb joints. Tender shoots were also burned for this purpose but were not considered as effective.

***Tanacetum vulgare* L. (Asteraceae). common tansy.**

Smith (1932) reported that the Flambeau Ojibwa of North America mixed this species with other plants and smoked them to attract deer during hunting expeditions.

***Tapinanthus* sp. (Loranthaceae). showy mistletoes.**

The stems and shoots of this species were mixed with other plants and burned for smoke that was considered useful in treating a variety of respiratory illnesses in children in the Democratic Republic of Congo (Disengomoka et al. 1983).

***Tarchonanthus camphoratus* L. (Asteraceae). wild camphor bush.**

Green branches produce smoke that the Sotho of Africa inhaled to relieve headaches (Watt and Breyer-Brandwijk 1962). In other parts of Africa, the leaves were smoked for the treatment of asthma and other respiratory illnesses (Watt and Breyer-Brandwijk 1962). Elsewhere in South Africa, the plant was smoked to treat headaches and rheumatism (Hedberg and Staugård 1989; Hutchings and van Staden 1994). The Hottentot of Africa smoked the leaves, which taste like camphor, for recreational purposes (Usher 1974).

***Tarenna graveolens* (S. Moore) Bremek. var *graveolens* (Rubiaceae). near marere.**

This tree was prized for its use as a general fumigant by the Borana of Ethiopia and by the Gabbra and Samburu of Kenya (Heine and Brezinger 1988; Heine and König 1988a).

***Tauschia parishii* J. F. Macbr. (Apiaceae). Parish's umbrellawort.**

The roots were smoked by the Kawaiisu of North America for the relief of pain, colds, and sore eyes (Zigmond 1981).

***Taxus baccata* L. (Taxaceae). English yew.**

In Europe, unspecified parts of this plant were burned as part of shaman incense mixtures that included *Abies* Mill. spp., *Hyoscyamus niger* L., *Juniperus communis* L., *Artemisia vulgaris* L., *Taxus baccata* L., and *Thymus serpyllum* L. (Rätsch 2004). They were also used as part of a mixture burned during Nordic Christmas ceremonies.

***Teclea nobilis* Delile (Rutaceae). small fruited teclea.**

The leaves were smoked in parts of Kenya to reduce fever (Mohagheghzadeh et al. 2006).

***Teclea simplicifolia* (Engl.) Engl. (Rutaceae). Teclea.**

This plant is used for beekeeping practices in northern Kenya (Brenzinger et al. 1994). The Mukogodo Maasai burned the whole plant to attract bees to new hives.

***Tectona grandis* L. f. (Verbenaceae). teak.**

Members of the Bhil tribe of India's Rajasthan State fumigated people suffering from guinea worm with the smoke of burning leaves (Singh and Pandey 1998). The sawdust of this species was used for the preparation of incense in Java, Indonesia (Sangat-Roemantyo 1990).

***Tephrosia hamiltonii* J. R. Drumm. (Fabaceae). indigo rouge.**

The Gujarat of Ratan Mahal in India smoked the leaves, mixed with those of tobacco (*Nicotiana* spp.), for its antitussive properties (Bedi 1978).

***Tephrosia pumila* Pers. (Fabaceae). indigo sauvage.**

In India's Amravati Tahsil District in Maharashtra State, the roots of indigo sauvage were smoked to stop coughs (Deshmukh et al. 2000).

***Terminalia avicennioides* Guill. and Perr. (Combretaceae). Avicenna's almond.**

In tropical Africa, resin from the trunk of this species was burned and used for incense purposes (Uphof 1968; Usher 1974).

***Terminalia brownii* Fresen. (Combretaceae). darot.**

Smoke generated in saunalike chambers in huts was used to perfume and cleanse Borana women in southern Oromia, Ethiopia (Gemedo-Dalle et al. 2005). For more information on this practice, see *Acacia goetzei* Harms. They also burned the bark and stems as incense, as did the Gabbra of Kenya (Heine and Brenzinger 1988). West African women burned sachets of rhizomes and tubers of this species to scent their bodies (Wickens 2004).

***Terminalia chebula* Retz. (Combretaceae). myrobalan.**

In Tibet, unspecified parts of this plant were smoked to relieve asthma (Tsarong 1986).

***Terminalia ivorensis* Chev. (Combretaceae). black atara.**

Asita and Campbell (1990) reported that the wood of black atara could be burned to produce smoke that effectively inhibited two species of bacteria—*Staphylococcus aureus* and *Saccharomyces cerevisiae*—both of which are known to spoil food.

***Terminalia orbicularis* Engl. & Diels. (Combretaceae). bísikh.**

The Rendille of Kenya (Heine and Heine 1988b), the Gabbra of Kenya (Heine and Brenzinger 1988), the Samburu of Kenya (Heine and König 1988a), and the Borana of Ethiopia (Heine and Brenzinger 1988) all burned this plant to fumigate and cleanse their containers. *Bísikh* is the Kenyan name for this species.

***Tessaria absinthioides* DC. (Asteraceae). suncho rosado.**

The pre-Altiplanic community of Chile prized the stems and roots of this species for incense purposes (Aldunate et al. 1983).

***Tetradenia riparia* (Hochst.) Codd. (Lamiaceae). ginger bush.**

In Ethiopia, wood was burned for smoke that was reportedly useful for relieving colds (Mohagheghzadeh et al. 2006).

***Teucrium polium* L. (Lamiaceae). kalpoureh.**

According to Avicenna, the fumes of burning leaves were used in parts of Iran as pest repellents (Mohagheghzadeh et al. 2006).

***Thalictrum dasycarpum* Fisch. & Avé-Lall. (Ranunculaceae). purple meadow rue.**

The Potowatomi of North America dried the seeds of this plant and then smoked them to bring good luck while hunting (Smith 1933). The seeds were also mixed and smoked with tobacco (*Nicotiana* spp.) by young men wishing to call on lady friends.

***Thalictrum fendleri* Engelm. ex. A. Gray (Ranunculaceae). Fendler's meadowrue.**

The Native Americans of New Mexico smoked the whole plant for pleasure and to relieve headaches (Krochmal and Krochmal 1973). Other Native Americans inhaled the smoke to treat colds (Foster and Hobbs 2002).

***Thamnosma africana* Engl. (Rutaceae). flea bush.**

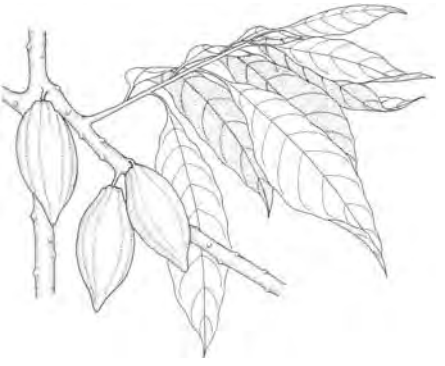
The Topnaar of Namibia smoked unspecified parts of this plant to relieve chest pains (van den Eynden et al. 1992).

***Thaumatococcus daniellii* (Benn.) Benth. (Marantaceae). African serendipity berry.**

In Nigeria, two sweet proteins were discovered from the fruit aril, which have been used to flavor tobacco (*Nicotiana* spp.) (Higginbotham et al. 1981).

***Theobroma cacao* L. (Sterculiaceae). chocolate plant.**

During Cuna female puberty rites in Panama, two burning cacao beans were placed on the ground, and everyone participating in the rite inhaled the smoke (Duke 1968). When burned with red peppers, the Cuna claimed that the smoke could treat malaria (Duke 1975). In Aligandi, Panama, the smoke from unspecified parts of the plant was reported useful in driving away evil spirits (Duke 1968).



Theobroma cacao

***Thermopsis rhombifolia* (Nutt. ex Pursh) Richards. (Fabaceae). prairie thermopsis.**

The Plains tribes of North America burned the flowers with human hair to generate smoke used to treat rheumatism (Gilmore 1919).

Thuja occidentalis L. (Cupressaceae). arborvitae. (figure 22)

The Cree of Hudson Bay, Canada, used the leaves or fibers of this plant to produce smoke for its pleasing fragrance (Wilson 1857). The Flambeau and Pillager Ojibwa of North America (Smith 1932) and Forest Potawatomi (Smith 1933) burned the leaves and used the smoke as a purifying agent. This was especially common during certain ceremonies, when the participants and sacred objects were fumigated.

Figure 22. *Thuja occidentalis* and other *Thuja* species were often burned for their fragrant smoke and to disinfect houses.

Thuja orientalis L. (Cupressaceae). Oriental arborvitae.

This species was used both in China and in the United States. In China, the roots were burned together with those of *Lindera fragrans* Oliv. for incense purposes (Henry 1893). The Flambeau Ojibwa of North America burned the leaves for the same purpose (Smith 1932), and the Pillager Ojibwa used it as incense in sweat baths (Verrill 1943). The Flambeau Ojibwa used it as perfume during purification rites (Verrill 1943). The Menominee of North America produced the smoke for reviving an unconscious person (Vogel 1970). The Forest Potawatomi used it to exorcise evil spirits (Brinton 1876).

Thuja orientalis

***Thymus linearis* Benth. (Lamiaceae). satar farsi.**

This species was burned for incense purposes in Nepal (Manandhar 2002).

***Thymus integer* Griseb. (Lamiaceae). wild thyme.**

The whole plant was burned in Cyprus to produce smoke that was considered an excellent disinfectant (Georgiades 1987b). The Cypriot name for the plant is *livanitis*.

***Thymus schimperi* Ronniger (Lamiaceae). garden thyme.**

This herb was used as a condiment in Ethiopia but has also found use as a treatment for gonorrhea and for cough and liver disease. It was mostly drunk as an infusion for these purposes but was also smoked (Getahun 1976). Its Ethiopian name is *tossigne*.

***Thymus serphyllum* L. (Lamiaceae). thyme.**

People in the Ubage Valley of France burned the complete plant to produce smoke that was used as an antiseptic and emollient and to treat foot-and-mouth disease (Novaretti and Lemordant 1990).

Thymus serphyllum

***Tilia americana* L (Tiliaceae). American basswood.**

The Meskwaki of North America used the smoke of burning fibers, which they called *wikup,* to dry and preserve meats (Smith 1928).

***Tilia cordata* Mill. (Tiliaceae). little leaf linden.**

The leaves were often used as a tobacco (*Nicotiana* spp.) adulterant (Lewis and Elvin-Lewis 2003). No other details were given.

***Tinospora sinensis* (Lour.) Merr. (Menispermeaceae). Chinese tinospora.**

In Vietnam, this plant was employed as an anal fumigant meant to treat piles and ulcerated wounds (van Duong 1993).

***Tournefortia argentea* L. f. (Boraginaceae). velvet soldier bush.**

The leaves were smoked for unspecified purposes in the Seychelles (Lewis and Elvin-Lewis 2003).

***Toxicodendron diversilobium* (Torr. & Gray) Greene. (Anacardiaceae). Pacific poison oak.**

This plant produces an oleoresin in its sap that can cause serious allergic reactions on contact. This potent allergen, called *urushiol*, can be carried along with smoke and dust particles when the plant is burned (Diggs et al. 1999). The resins in the smoke can deposit on skin, eyes, and other surfaces causing dermatitis, or they can be inhaled causing severe airway irritation. The effects of this plant are probably similar for all of the species of *Toxicodendron*. The most poisonous or toxic species is *T. radicans* (L.) Kuntze. Members of this genus are often included in the *Rhus* genus.

Toxicodendron orientale

***Toxicodendron orientale* Greene (Anacardiaceae). Asian poison ivy.**

This species also produces urushiol and can be carried in smoke when the plant is burned (Diggs et al. 1999).

***Toxicodendron pubescens* Mill. (Anacardiaceae). Atlantic poison oak.**

Although there is no clear evidence to suggest that the smoke of this species can irritate skin and respiratory surfaces, it is likely that it will because the species is known to produce harmful substances that may be carried along with smoke particulates.

***Toxicodendron radicans* (L.) Kuntze. (Anacardiaceae). western poison ivy.**

This plant also produces the oleoresin urushiol in its sap. It is produced in all parts of the plant and can be carried along with smoke and dust particles when the plant is burned (Myths and facts about poison ivy 1998). The resins can deposit on skin and cause dermatitis or can be inhaled and cause severe airway irritation.

Toxicodendron radicans

***Toxicodendron rydbergii* (Small) Greene. (Anacardiaceae). Rydberg's poison ivy.**

Although there is no conclusive evidence to suggest that the smoke of this species can irritate skin and respiratory surfaces, it is likely that it will because the species is known to produce harmful substances that may be carried along with smoke particulates.

***Toxicodendron succedaneum* (L.) Kuntze. (Anacardiaceae). Japanese waxtree.**

The smoke of this species, when burned, can irritate skin and respiratory surfaces.

***Toxicodendron vernicifluum* (Stokes) F. A. Barkley. (Anacardiaceae). Japanese lacquer tree.**

This species, which occurs in East Asia, China, and Japan, also produces urushiol and can be carried in smoke when the plant is burned (Diggs et al. 1999).

***Toxicodendron vernix* Kuntze. (Anacardiaceae). poison oak.**

When the leaves are burned, tiny droplets of resin can ride on particles of ash and smoke and can cause severe reactions (Erichsen-Brown 1979). The common name of this species is poison sumac.

***Trachylobium homemannianum* Hayne. (Fabaceae). sanodrus.**

According to Avicenna, smoke from burning resin was used in parts of Iran as a fumigant to dress wounds and to relieve coughs (Mohagheghzadeh et al. 2006).

***Tragia involucrata* L. (Euphorbiaceae). Indian stinging nettle.**

This species was an important ingredient in a concoction of plants and animals that, when burned to produce smoke, was reported to cause blindness in one's enemies according to book 4, chapter 1, topic 177 of the ancient Sanskrit treatise the *Arthaśāstra of Kautilīya* (fourth century B.C.) (Sensarma 1998). Included in the mixture were parts of an unidentified reed as well as unspecified parts of *Asparagus racemosus* Willd., *Butea monosperma* (Lam.) Taub. in Engl. & Prantl, *Paspalum scrobiculatum* L., *Ricinus communis* L., *Saussurea lappa* (Decne.) C. B. Clarke, and *Stephania hernandiflora* Walp.

***Trema orientalis* (L.) Blume (Ulmaceae). pigeon wood.**

In the Ivory Coast, the bark, leaves, stems, and twigs were all burned to produce smoke that was inhaled to treat asthma, bronchitis, cough, and sore throat (Kerharo and Bouquet 1950; Irvine 1961).

***Trichilia havanensis* Jacq. (Meliaceae). bastard lime.**

The people of Teenek Tsabaal in the Mexican states of Veracruz and San Luis Potosi burned the wood of this species and then fumigated their chickens with its smoke to rid them of lice (Alcorn 1984).

***Trichilia micrantha* Benth. (Meliaceae). tu-mour-reng-yik.**

The Barsana of Colombia smoked the leaves of this plant for pulmonary ailments (Schultes and Raffauf 1990). *Tu-mour-reng-yik* is the name given to this plant in the Guianas (Guyana, Suriname, and French Guiana).

***Trichocereus pachanoi* Britton & Rose (Cactaceae). San Pedro cactus.**

Archeological digs in Las Aldas, Peru, have revealed the remains of cigars that may have been smoked by the local people for their psychoactive properties (Sharon and Donnan 1977).

***Trichocline auriculata* Hieron. var. *auriculata* (Asteraceae). pampaballa.**

In northwestern Argentina, the people smoked the roots and rhizomes in a cigarette to treat earache and deafness (Giberti 1983).

***Trichomanes javanicum* Blume (Hymenophyllaceae). aqua fern.**

In India, unspecified parts of this plant were smoked to relieve headaches (Singh G. S. 2000).

***Trichosanthes palmata* Roxb. (Cucurbitaceae). thowan.**

Some Native Australian tribes smoked the leaves for relief from asthma attacks (Webb 1948).

***Trichosanthes tricuspidata* Lour. (Cucurbitaceae). bracted snake gourd.**

The dried leaves were smoked to relieve asthma and coughs in India's Mizoram State (Lalramnghinglova 2003). *Vankhaum* is its local name.

***Trientalis americana* Pursh. (Primulaceae). American starflower.**

The Flambeau Ojibwa of North America mixed the roots with other species and smoked the mixture to attract deer during hunting sessions (Smith 1932).

***Trientalis borealis* Raf. (Primulaceae). starflower.**

The Ojibwa of North America reportedly mixed the roots of this species with other plants to produce scented smoke that was used to attract deer to hunters (Smith 1932).

***Trifolium pretense* L. (Fabaceae). red clover.**

In the Appalachians of North America, parts of this plant were burned to produce smoke that was inhaled to treat asthma (Krochmal et al. 1969).

***Trilisa odoratissima* (J. F. Gmel.) Cass. (Asteraceae). vanilla trilisa.**

Native North Americans of the southeastern United States smoked the leaves, which contain coumarin, as a cigarette and cigar flavoring agent (Uphof 1968; Krochmal and Krochmal 1973; Lewis and Elvin-Lewis 2003).

***Triticum dicoccum* Schrank (Poaceae). emmer.**

According to ancient Egyptian texts, emmer seeds were burned for fumigations that were used for contraceptive purposes (Manniche 1989). The smoke was believed to prevent penetration but only after drinking a concoction made of celery and other plants.

***Triumfetta rhomboidea* Jacq. (Tiliaceae). diamond burrbark.**

Excessive smoking of the leaves, when mixed with those of tobacco (*Nicotiana* spp.), rendered men impotent and therefore was considered useful for birth control in the Dahanu Forest division of Maharastra State, India (Shah et al. 1983).

***Trixis californica* Kell. var *californica* (Asteraceae). rattlesnake's foreskin.**

The Seri of Mexico smoked the leaves for pleasure (Felger and Moser 1985).

***Tsuga dumosa* Eichl. (Pinaceae). Himalayan hemlock.**

The leaves were harvested and burned as incense in Nepal (Manandhar 2002).

***Tsuga heterophylla* Sarg. (Pinaceae). western hemlock.**

In British Columbia, Canada, the Thompson and Lillooet used the smoke of this species to preserve hides (Turner 1988).

***Tuinaea aethiopica* Hook. f. (Lamiaceae). Tuinaea.**

The Borana of Ethiopia and the Gabbra of Kenya used this species to fumigate and cleanse their containers. Dried branches were cut, set alight, and then placed inside the container (Heine and Brenzinger 1988).

***Turnera diffusa* Willd. ex Schult. (Turneraceae). damiana.**

The dried leaves were smoked as a gentle nervine or relaxant with a pleasant aroma (Ross 2002).

***Tussilago farfara* L. (Asteraceae). coltsfoot.**

The leaves of coltsfoot were smoked to relieve asthma in parts of Greece (Sfikas 1981), Ireland (Logan 1972), Italy (Chiappini 1981), and Scotland (Milliken and Bridgewater 2004). Native North Americans inhaled the smoke from burning leaves to treat a sore throat (Kavasch 1979) and to dry out a cough (Brill 1994). In parts of Russia, Ukraine, Belarus, the Caucasus, and central Asia, it was smoked two to three times daily as a remedy for spastic cough (Turova 1967). The leaves of the species were also smoked as a substitute for tobacco (*Nicotiana* spp.) in Asia, Europe, and North America (Uphof 1968; Kavasch 1979).

Tussilago farfara

***Uapaca bojeri* Baill. (Euphorbiaceae). tapia.**

In Madagascar, the leaves of this species were fermented, dried, and then smoked to treat pulmonary infections (Boiteau and Allorge-Boiteau 2000). *Tapia* is the Madagascan name for this species.

***Umbellularia californica* (Hook & Arn.) Nutt. (Lauraceae). California bay laurel.**

Native Americans used the smoke of burning leaves as a flea repellent (Foster and Hobbs 2002).

***Utricularia inflexa* Forssk. (Lentibulariaceae). star bladderwort.**

A variety of children's respiratory diseases were treated in the Democratic Republic of Congo with the smoke of burning star bladderwort leaves (Disengomoka et al. 1983).

***Valeriana hardwickii* Wall. (Valerianaceae). Indian valerian.**

The leaves were burned as incense by the Himachal Hills people of India (Sharma and Rana 2000).

***Valeriana jatamansi* Jones (Valerianaceae). mushkbala.**

The Kumoan and Garhwarl of northern India burned dried roots for incense purposes and for magico-religious rituals (Shah and Joshi 1971; Shah

Umbellularia californica

1982). It was considered a sacred plant in India (Dhiman 2003), where it was sometimes known as *samyo*. In Nepal's Manang District, the roots were burned as incense because of their intense aroma (Pohle 1990).

***Valeriana wallichii* DC. (Valerianaceae). valerian.**

The roots were burned as incense by the Himachal Hills people of India (Sharma and Rana 2000).

***Vateria indica* L. (Dipterocarpaceae). piney varnish tree.**

The oleoresins produced by this species were collected in parts of India and burned as incense (Groyer and Rao 1981).

***Verbascum blattaria* L. (Scrophulariaceae). moth mullein.**

According to North American folklore, the leaves were smoked to relieve asthma (Brendle and Unger 1935).

***Verbascum thapsus* L. (Scrophuliaraceae). great mullein.**

The flowers and seeds of this species were commonly smoked for the symptomatic relief of asthma and other pulmonary illnesses (Lewis and Elvin-Lewis 2003). Native North Americans inhaled the smoke of burning leaves to treat sore throats, asthma, and coughs (Kavasch 1979). It was also considered useful for relieving congestion and inflammation of the lungs (Tierra 1983). According to Speck (1917), the Penobscot inhaled the smoke of burning leaves to treat asthma, as did the Forest Potawatomi (Smith 1933), the Mohegan (Krochmal and Krochmal 1973), and other North American tribes (Brendle and Unger 1935) as well as the Spanish people of New Mexico (Krochmal et al. 1969). They also used the smoke to relieve sore throats and prepared smoke smudges to treat catarrh and to revive unconscious people (Tantaquidgeon 1928). The Flambeau Ojibwa of North America smoked the leaves to relieve asthma and bronchitis (Smith 1932). The Ozarker people of the U.S. Midwest smoked dried leaves for the treatment of asthma and coughs (Liebert 1987). The Menominee inhaled smoke from burning roots to treat a variety of pulmonary diseases (Smith 1933). The Ktunaxa of British Columbia, Canada, and other North American areas made their horses inhale the smoke to clear their nostrils, especially if they were plugged due to colds (Turner 1997). Dried leaves were smoked as an alternative to tobacco (*Nicotiana* spp.) in the remote tribal areas of the Almora District of India (Arya and Prakash 2000). In other parts of India, dried leaves were smoked for the treatment of asthma and sporadic cough (Kirtikar and Basu 1935). It was used for similar purposes in central and southern Europe and western Asia (Usher 1974). In the upper Lucca Province of Italy, the leaves of this species were often smoked with tobacco for recreational purposes (Pieroni 2000). In the Kala Chitta Hills of the Attock District of Pakistan, smoke from the leaves was inhaled to treat chest complaints and to relieve asthma (Mahmood et al. 2004). The leaves were smoked for unspecified purposes in Tibet (Tsarong 1986) and were smoked to treat lung congestion, urinary tract infections, and diarrhea in many unspecified countries (Saeed et al. 2004).

Verbascum thapsus

***Vernonia anthelmintica* Willd. (Asteraceae). ironweed.**

In the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya*, unspecified parts of this species were listed as one of several ingredients in a mixture burned to produce smoke used to deliberately kill animals (see recipe 3 under *Asparagus racemosus* Willd.) (Sensarma 1998). The smoke was considered so deadly that it was said to kill for as far as the wind would carry it.

***Vernonia natalensis* Sch. Bip. ex Walp. (Asteraceae). silver vernonia.**

The Swazi of Africa inhaled the smoke from burning silver vernonia plants for relief from headaches (Gelfand et al. 1985). In Zimbabwe, smoke from burning leaves was inhaled to drive away evil spirits (Gelfand et al. 1985).

***Vetiveria zizanioides* Nash (Poaceae). vetivergrass.**

In Java, Indonesia, the roots of this species were burned for incense purposes (Sangat-Roemantyo 1990).

***Viburnum pubescens* Pursch. (Caprifoliaceae). black haw.**

The Pillager Ojibwa of North America used the bark in their kinnikinnick smoking mixtures, which they smoked for various reasons (Smith 1932).

***Vicia faba* Pers. (Fabaceae). horse bean.**

In the L'Alt Empordà and Les Guilleries regions of Catalonia in the Iberian Peninsula, the fruits of this plant were burned to produce smoke, which was inhaled as a tonic (Bonet et al. 1999).

***Viola epipsila* Ledeb (Violaceae). dwarf marsh violet.**

The Dena'ina of Alaska burned the roots of this species on top of wood stoves as incense and used the smoke to keep illness away (Kari 1995).

***Virola sebifera* Aublet (Myristicaceae). cuajo negro.**

The shamans of Venezuela once prescribed the smoke of burning inner bark to cure fevers (Schultes and Hofmann 1991).

***Virola* spp. (Myristicaceae). Virola.**

The inner bark of an indeterminate *Virola* species was smoked in parts of South America because it induced hallucinations (Schultes and Holmstedt 1971). Brazilian shamans smoked parts of an unspecified virola for its psychedelic properties (McKenna et al. 1984).

***Vitex agnus-castus* L. (Verbenaceae). hemp tree.**

The entire plant was used as a fumigant to induce menstruation in women in the Arab world (Ross 2001).

***Vitex negundo* L. (Verbenaceae). Indian privet.**

In Maharashtra State, India, the leaves were burned at night to produce smoke that was believed to protect tribal members from mosquito bites (Parrotta 2001) and to repel insects in Rewalsar, India (Sood and Thakur 2004). The smoke produced by burning dried leaves was inhaled as a headache remedy in Nepal (Manandhar 2002) and in parts of India's Rajasthan State, where this species is known as *nirgundi* (Singh and Pandey 1998). The people of Rayalaseema in Andhra Pradesh, India, burned the leaves of this species under a blanket, where they sat and inhaled the smoke to relieve coughs (Nagaraju and Rau 1990).

Vitex negundo

***Vitex trifolia* L. (Verbenaceae). simple leaf chase tree.**

In Samoa (Whistler 2000) and in parts of Malaysia (van Duong 1993), this plant was once burned to repel mosquitoes. The Samoans now use commercially available mosquito coils. When neither is available, they resort to burning coconut husks (*Cocos nucifera* L.).

***Vochysia laxiflora* Stafleu (Vochysiaceae). Vochysia.**

Members of the Amazon tribes of Rio Apaporis, Colombia, burned the bark of this plant and inhaled its smoke to relieve asthma (Schultes and Raffauf 1990).

***Waldheimia tomentosa* Regel (Asteraceae). makungla.**

In the desert region of Ladahk, India, this plant was dried and then burned as a fumigant to repel insects, especially around sheep and goats (Chaurasia et al. 2000). *Makungla* is the local name for this species.

***Waltheria indica* L. (Sterculiaceae). uhaloa.**

The Sukuma of Tanzania smoked root flour for the relief of sore throat (von Reis and Lipp 1982).

***Warburgia salutaris* (Bertol. f.) Chiov. (Canellaceae). pepper bark tree.**

In Africa, the Zulu smoked the leaves of this species with those of *Cannabis sativa* L. for the relief of dry coughs (Bryant 1966).

***Warburgia ugandensis* Sprague (Canellaceae). pepper bark.**

The So of Uganda burned the wood in their fires because the smoke's aroma was believed to keep leopards away (Heine and König 1988b). The smoke from burning powdered bark was inhaled elsewhere (unspecified) as a remedy for chest complaints (Iwu 1993).

***Watsonia densiflora* Baker (Iridaceae). bugle lily.**

The Zulu of South Africa used the flower stalks for unspecified smoking purposes (Hulme 1954).

***Widdringtonia whytei* Rendle. (Cupressaceae). mlanje-cedar.**

No details were given except that the wood was burned in central Africa as incense (Usher 1974).

***Withania somnifera* (L.) Dunal. (Solanaceae). winter cherry.**

This species was used to fumigate and cleanse containers by the Borana of Ethiopia and by the Gabbra of Kenya (Heine and Brenzinger 1988). In Morocco, midwives burned this and other species to produce fumes that were used to induce abortions (Merzouki et al. 2000). See *Atractylis gummifera* L. for a list of the other species used in this polyherbal recipe.

***Xanthorrhoea latifolia* (A. T. Lee) D. J. Bedford (Xanthorrhoeaceae). mudigan.**

In Australia's east coast town of Byron Bay, the Arakwa burned this grass tree in their fires because it produces pleasant aromatic smoke that repels mosquitoes (Byron Bay Arakwal Elders 2003).

***Xanthorrhoea preissii* Endl. (Xanthorrhoeaceae). balga.**

Campers all throughout Western Australia have burned grass trees in their campfires because the smoke generated is fragrant and pleasing (personal observation, Pennacchio).

***Xanthorrhoea resinosa* Pers. (Xanthorrhoeaceae). grass tree.**

In early colonial Australia, the smoke of burning grass tree resin was considered pleasantly aromatic and was prescribed as a "good pectoral medicine" by the then Surgeon General John White (Cribb and Cribb 1981). Its use did not endure for long, however.

***Xeromphis spinosa* (Thunb.) Keay (Rubiaceae). thorny bone apple.**

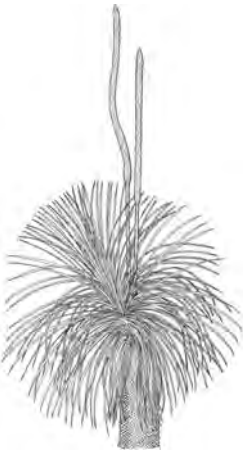
The chaff of the seeds of this species is listed in the fourth-century B.C. Sanskrit treatise the *Arthaśāstra of Kautilīya* as one of several ingredients in a mixture burned to produce smoke to blind one's enemies (mix 2 under *Asparagus racemosus* Willd.) (Sensarma 1998). It was also used in a mixture of plants that, when burned, produced deadly smoke that was used to kill animals (recipe 4 under *Asparagus racemosus* Willd.).

***Xerophyta equisetoides* Baker (Velloziaceae). Xerophyta.**

In Zimbabwe, smoke from the whole plant was inhaled to stop nosebleeds (Gelfand et al. 1985).

***Xerophyta equisetoides* Baker var. *equisetoides* (Velloziaceae). Xerophyta.**

In Tanzania, dried roots were burned, and the smoke was inhaled to treat asthma (Watt and Breyer-Brandwijk 1962).



Xanthorrhoea preissii

***Xerophyta retinervis* Baker (Velloziaceae). black stick lily.**

The roots of this species were smoked in South Africa to relieve asthma and to stop nosebleeds (Watt and Breyer-Brandwijk 1962; Iwu 1993; Hutchings et al. 1996).

***Xerophyta* spp. (Velloziaceae). Xerophyta.**

In Swaziland, the dried roots of several species within this genus were smoked for the relief of asthma (Watt and Breyer-Brandwijk 1962).

***Ximenia caffra* Sond. (Olacaceae). large sourplum.**

The Vhavenda of Tanzania burned powdered root to produce smoke that was inhaled to stop nosebleeds (Mabogo 1990).

***Xylocarpus granatum* Koen. (Meliaceae). cedar mangrove.**

The smoke generated by mosquito coils made with the roots of this plant has been shown to repel or kill mosquitoes (*Culex quinquefasciatus*) according to Thangam and Kathiresan (1992).

***Xylopia aethiopica* A. Rich. (Annonaceae). Ethiopian pepper plant.**

In West Africa, the fruit of this species was pounded and then smoked with tobacco (*Nicotiana* spp.) for respiratory complaints (Dalziel 1948; Irvine 1961).

***Yucca glauca* Nutt. (Liliaceae). soapweed yucca.**

In western parts of the United States, Native Americans burned the roots for unspecified smoke purposes (Uphof 1968).

***Zanthoxylum capense* Harv. (Rutaceae). knobwood.**

In Swaziland, approximately 50 g of the whole plant was burned to produce smoke that was inhaled for 2 days to treat dizziness (Amusan et al. 2002).

***Zanthoxylum zanthoxyloides* (Lam.) B. Zepernick & F. K. Timler (Rutaceae). candlewood.**

Smoking the roots was considered a useful treatment for ascariasis according to the people of the Baganda of the Kamapala District of Africa's kingdom of Buganda (Hamill 2001). In other parts of West Africa, the bark was burned and used as a fumigant for unspecified purposes (Kerharo and Bouquet 1950; Irvine 1961).

***Zea mays* L. (Poaceae). maize.**

Zea mays

According to Lewis and Elvin-Lewis (2003), the dried silks of corn were traditionally smoked by an unspecified group of people as a tobacco (*Nicotiana* spp.) substitute. The Chickasaw of North America burned old corncobs and used the smoke to treat itching skin (Sahagún 1963). Eischen and Vergara (2004) tested the smoke for its ability to repel or kill honeybees (*Apis mellifera*) and tracheal mites (*Acarapsis woodi*). They reported that it exhibited low mortality. In Hungary, the smoke from burning several parts of the plant was considered useful for medicinal purposes. Smoke from the seeds and fruits, when burned, was used to treat horses with "heavy breath" and colds and flu (Oláh 1987). Smoke from burning red seeds was used as an abortifacient (Gémes 1987). Flour made from the seeds was burned by an unspecified group of people for smoke used to treat colds and flu (Vasas 1985). In India's Rajasthan State, where this species is known as *makki*, male flowers were often smoked for the relief of asthma (Singh and Pandey 1998).

***Zehneria scabra* Sond. (Cucurbitaceae). hareg ressa.**

The leaves of hareg ressa were smoked in Ethiopia for the treatment of general gynecological disorders (Mohagheghzadeh et al. 2006).

***Zinnia grandiflora* Nutt. (Asteraceae). wild zinnia.**

Native Americans used the smoke generated by burning this plant to control fever (Foster and Hobbs 2002).

***Ziziphus mauritiana* Lam. (Rhamnaceae). Indian jujube.**

Somali women used this species to fumigate and perfume their hair (Getahun 1976).

***Ziziphus mucronata* ssp. *mucronata* Willd. (Rhamnaceae). buffalo thorn.**

The Okavango of Africa burned pounded roots on glowing embers and inhaled the smoke that arose to treat open and swollen wounds (von Koenen 2001).

***Ziziphus nummularia* (Burm. f.) Wight & Arn. (Rhamnaceae). jujube.**

Smoke from burning leaves was inhaled by native Qataris to treat colds and nasal discharges (Rizk and El-Ghazaly 1995). The Arabic name for the plant is *kanar*.

***Zornia glochidiata* Rchb. ex DC. (Fabaceae). Kastilia.**

To keep spirits at bay, the people of Bulamogi County, Uganda, smoked the leaves of this species (Tabuti et al. 2003).

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GLOSSARY OF TERMS AND ABBREVIATIONS

abortifacient: A substance that induces or causes an abortion in pregnant females.
abscess: An inflamed area of the skin, where pus has formed.
A.D.: *Anno Domini*. A period of time since the start of the Christian era.
adytum: A religious sanctuary or inner sanctum usually open only to priests and priestesses.
aire: An illness that may or may not be caused by supernatural beings. In traditional Hispanic communities of the southwestern United States, the illness, which manifests itself in many ways, can be onset by a sudden change in temperature.
a.k.a.: Abbreviation for "also known as."
alkaloid: A basic nitrogenous compound produced naturally by plants, many of which are pharmacologically active (e.g., nicotine and atropine).
allergen: A substance or agent that causes an allergy.
amenorrhea: An abnormal disruption or ceasing of menstrual flow.
analgesic: A medicine or substance that alleviates pain without loss of consciousness.
ancylostomiasis: A disease caused by an infection of hookworms.
angina pectoris: A heart condition characterized by chest pains caused by a lack of oxygen to heart tissue.
angiosperm: A seed-bearing plant in which the ovule is encased within an ovary (e.g., magnolias and other flowering plants).
ANS: Autonomic nervous system. The ANS is part of the nervous system of all vertebrates and is responsible for involuntary actions through its sympathetic and parasympathetic systems.
antiasthmatic: A substance or agent that relieves asthma or its symptoms.
anticatarrhal: An anti-inflammatory agent that prevents inflammation in the mucous membranes of air passages.
antidermatosic: A substance or agent that prevents diseases of the skin.
antiecchymotic: A substance or agent that prevents blood from escaping into tissues from ruptured blood vessels.
antiseptic: A substance or agent that prevents the growth of microorganisms.
antispasmodic: A substance or agent that relieves or calms nervous and muscular spasms.
antivertiginous: A substance or agent that counters dizziness.
aphrodisiac: Any substance or agent that arouses sexual desire; named after the Greek goddess of love, Aphrodite.
apoplexy: A stroke during which there is loss of consciousness and loss of muscular control. These are usually caused by blood clots in the blood vessels of the brain.
aromatic: A substance or agent with a fragrant or spicy odor.
ascariasis: An infection caused by a parasitic roundworm.
asthma: A respiratory condition often associated with allergic reactions that result in labored breathing, wheezing, coughing, and a feeling of constriction of the chest.
Avicenna: Ibn Sīnā is regarded by many as the father of modern medicine and pharmacology. He was born ca. 980 in what is now Uzbekistan and died in 1037 in modern Iran.

axonic: Of or relating to the axons, or individual nerve cells, of the nervous system.

Ayurvedic medicine: An indigenous Indian medical system based on Hindu scriptures, or Vedas. *Ayurveda* is an ancient Sanskrit word meaning "the science of life."

B.C: Before Christ. A period of time prior to the Christian era.

bechic agent: A substance or agent that relieves coughs.

biliousness: A liver disease or condition often characterized by excessive bile production.

biodiversity: The totality of genes, species, and ecosystems of a geographical region.

biosynthesis: The buildup of chemical compound using simpler "building blocks" (e.g., amino acids, simple sugars), which is usually catalyzed by an enzyme.

bronchitis: An inflammation of one or more bronchi of the lungs.

ca.: Circa; approximately.

Camas: Any plant of the *Camassia* genus of the lily family, Liliaceae.

carcinogen: Any substance or agent that causes cancer.

carminative: Any substance or agent that helps expel gas from the stomach or intestine.

catarrh: A condition whereby there is inflammation of the mucous membranes of human nasal and air passages.

cathartic: A substance or agent that induces bowel movements.

censer: An incense burner.

chaparral: A biome in the western United States characterized by hot, dry summers and cool, moist winters. It is usually dominated by a dense growth of mostly small-leaved evergreen shrubs rich in highly flammable resins, which aid the frequent wildfires.

chiclero: A Spanish word that describes a gatherer of latex, especially from the Sapodilla tree (known as *chicle*). This formed the base for commercial chewing gum until synthetic gums replaced it in the 1930s.

CNS: Central nervous system. The CNS forms part of the nervous systems of vertebrates and consists of the brain and spinal cord, through which all motor impulses are relayed to the muscles and all sensory input is received. The CNS coordinates the entire nervous system.

CO: Carbon monoxide gas.

CO_2: Carbon dioxide gas.

colic: A medical condition related to acute abdominal pain caused by spasms, obstruction, and twisting of hollow and other organs.

congeneric: Belonging to the same genus.

copal: Plant resins used in Mesoamerica for incense and other purposes. The word was derived from the Aztec Nahuatl word *copalli*.

cotyledon: The leaves of an embryonic plant. These usually emerge shortly after the plant has sprouted. Monocotyledons produce one leaf, and dicotyledons produce two.

coumarin: A natural white crystal lactone often used as a flavoring agent in soaps, perfumes, and other items ($C_9H_6O_2$).

crack cocaine: Free-base cocaine in which the hydrochloride salt is removed by processing the alkaloid with ammonia or baking soda so that it can be smoked for its euphoric effects.

cyclopegia: Loss of accommodation in the eye and therefore the ability to adjust vision over different distances.

DDT: Dichlor-diphenyltrichlor. A colorless, odorless insecticide that tends to accumulate in ecosystems and has toxic effects on many vertebrate species.

DEET: N, N-diethyl-3-methylybenzamide. DEET is a synthetic insect repellent that was developed by the U.S. Department of Agriculture and patented by the U.S. Army in 1946 (Fradin 1998). It remains one of the most effective insect repellents on the market.

delirium: A frenzied mental state characterized by confusion, hysteria, slurred speech, or hallucinations.

demographic stochasticity: Random fluctuations in birth and/or death rates.

dermatitis: A skin condition caused by allergens and other agents and often associated with inflammation.

distemper: A highly contagious bacterial infection in animals that results in a fever and swollen throat glands. The animal usually loses appetite but rarely dies.

divination: The art of foretelling or foreseeing the future, usually while communing with gods or the spirit world.

dormancy: A seed that does not have the capacity to germinate in a specified period of time under any combination of normal physical environmental factors, which are otherwise favorable for its germination (Baskin and Baskin 2004).

ectoparasite: Any parasite that lives on the exterior of its host.

emetic: A substance or agent that induces vomiting.

emmenagogue: An agent that regulates or induces menstruation by acting directly on the reproductive system or by alleviating the condition through a secondary mechanism.

emollient: A substance that soothes, softens, or makes skin and other surfaces (e.g., mucous membranes) less harsh.

emphysema: A condition of the lungs in which there is significant and harmful enlargement of the air vesicles. The condition is often associated with tobacco smokers.endemic: Native to a limited region or area.

endogenous: Substances that originate from within an organism, tissue, or cell.

endophytic: Of or relating to organisms that live within plants.

entheogen: This term is often used in a broad sense to refer to the use of psychoactive substances to alter perceptions or consciousness in humans. It is derived from two ancient Greek words, *entheos* and *genesthal,* which literally translate to "that which causes one to be in god."

epidemic: A substance or agent that affects a large proportion of a population (e.g., the Bubonic plague).

epilepsy: A chronic nervous disorder in which there is disturbed electrical activity in the central nervous system leading to convulsions, partial loss of consciousness, and sometimes death.

erythrocytes: Red blood cells.

euphoria: A state of elation or well-being.

eviscerated: When the viscera, or internal organs, of an animal have been removed. This usually pertains to animals that humans consume, such as fish.

ex situ: Not in its natural habitat.

exaltation: A heightened sense of importance or well-being.

excoriate: To abrade the skin.

exogenous: A substance or agent that originates from outside an organism, tissue, or cell.

expectorant: A substance or agent that promotes the expulsion of mucous membrane secretions.

febrifuge: A substance or agent that reduces fever.

frond: A large leaf with many divisions that is usually of the type seen in palms and ferns.

fumigate: To apply smoke to.

furuncles: Boils of the body that result from infections of hair follicles. The condition is referred to as *furunculosis*.

galactagogue: A substance or agent that induces or increases the secretion of milk.

germination: The process during which seeds begin to grow.

ghee: A semifluid-like clarified butter commonly made and used in India.

gringo: A Spanish alteration of the Greek word *griego,* meaning "foreigner" or "stranger."

gumpas: Monasteries in northern India.

gymnosperms: Plants that do not possess ovules encased within an ovary (e.g., pine trees).

hallucinogen: A substance that induces visions or other distorted sensory illusions.

hemicrania: Pain or headache that affects only one side of the head.

hemp: Of or relating to the plant *Cannabis sativa*.

hexameter: A line of verse often possessing six metrical measures. Priests relaying the divined responses of the Delphic oracle, the Pythia, usually used it in ancient Greece.

impermeable: Does not permit water to pass through it.

incantations: Spells or verbal charms sung or spoken as part of magico-religious rituals.

in situ: In a natural habitat.

nsecticide: An agent used to kill insects.

invasive plant: A plant that grows outside its native range and tends to outcompete native flora.

inzagomas: Zulu diviners of South Africa.

Isthmian America: The region of the Americas that includes all the countries from Mexico to Colombia.

IUCN: International Union for Conservation of Nature and Natural Resources.

kif: A traditional pipe used in Morocco.

kinnikinnick: An Algonquin (Native American) word for tobacco blends and sometimes used to refer to *Arctostaphylos* species.

kippers: Herring or salmon that has been split from head to tail, eviscerated, salted, and smoked.

kiva: A subterranean or partially submerged chamber used for various ceremonies or councils by the Jevez of New Mexico, United States.

kraals: An Afrikaans word meaning enclosure for cattle.

leprosy: A progressively deteriorating condition of the skin caused by the bacterium *Mycobacterium leprae*.

Lilliputian: An adjective meaning small or puny and often used to refer to hallucinogenic images of insects and other small animals. The term entered common use after the Lilliputian people, a small fictional race of people living on the island of Lilliput, appeared in the widely acclaimed Jonathan Swift novel *Gulliver's Travels*.

lumbago: Lower back pain.

malaria: A disease in which human red blood cells are infected with a protozoan parasite of the genus *Plasmodium*.

manteion: A mantic or prophetic chamber, such as the one used by ancient Greece's oracle of Delphi.

mantic: Of or relating to religious or other divination.

mastitis: An inflammation of the breast or udder that usually is caused by infection.

mg: Milligram. One-thousandth of a gram.

miasma: A vapor or exhalation believed to corrupt the atmosphere.

morphine: An analgesic and narcotic alkaloid produced by the opium poppy, *Papaver somniferum*. The alkaloid was named after *Morpheus*—the Greek god for dreams or sleep.

moxa: Any combustible material, usually of plant origin, that is burned and used as part of traditional Chinese acupuncture (see *Artemisia vulgaris* in chapter 2).

mutagen: Any agent that increases the likelihood of mutations in an organism.

mydriasis: A prolonged or excessive dilation of the pupil of the eye.

narcotic: This term is derived from the Greek work *narkoyn* and refers to any substance capable of inducing sleep or drowsiness or diminishes pain (e.g., morphine).

neuralgia: Nerve pain.

nymph: A beautiful maiden often associated with mythology.

O_2: Oxygen gas.

oleoresin: A natural plant product that combines essential oils with resins.

omphalos: The so-called navel stone on which the oracle at Delphi's tripod stool was fastened and under which gases from a small hole were vented to the oracle, inducing psychic visions.

ophthalmia: An inflammation of the conjunctiva or eyeball.

opiates: Drugs or compounds derived from opium.

oracle: A priestess of ancient Greece through whom gods could communicate with mortals.
otitis: An inflammation of the ear, which may include pain, fever, and other abnormalities.
oxytocic: A substance that hastens childbirth by inducing contractions of the uterus.
PAHs: Polycyclic aromatic hydrocarbons. These ubiquitous and often harmful chemical compounds are produced during the incomplete combustion of organic matter.
palliative: The relief or soothing of the symptoms of a disease without leading to a cure.
panacea: A cure-all.
pharmacopeia: A published compendium of medicines and drugs and their uses (also pharmacopoeia).
piles: Also known as hemorrhoids, this is a condition in which veins at the lower end of the anus become swollen, causing irritation, blood loss, and pain.
plague: An epidemic or disease that causes high rates of mortality.
pom: A tree gum or resin considered one of the darkest of the copals. It is commonly derived from the pitch pine *Pinus pseudostrobus*.
poultice: A soft substance or composition applied to sores or inflammations of the body.
prophylactic: A preventive measure or substance to guard against disease or illness.
propitiate: To reconcile with or appease a third party or gods.
proselyte: An alien resident.
psychosomatic: Of or relating to bodily symptoms caused by mental or emotional disturbance.
pyrethrins: A group of chemical substances used for their insecticidal properties.
pyrethroids: A group of synthetic chemical substances based on naturally occurring pyrethrins.
Pythia: The name that the Greek god Apollo gave to the Delphic oracle after he had created her by slaying the she-dragon at Delphi, Greece.
resin: Any semisolid or solid amorphous and flammable organic substance found in the secretions of certain plants.
rethrins: A group of chemical substances used for their insecticidal properties, such as the pyrethrins derived from *Chrysanthemum* species.
rheumatism: A condition or illness characterized by inflammation of the muscles, joints, or fibrous tissue.
salve: Usually an adhesive or other substance applied to sores or other wounds.
scurvy: A disease caused by a lack of vitamin C (ascorbic acid). Symptoms include bleeding of the gums and other body parts and loosening of the teeth.
sedative: Any substance or agent used to relieve tension or anxiety.
shaman: A priest or priestess who uses magico-religious treatments or divinations to cure the sick or dying.
smallpox: An acute and contagious illness caused by a poxvirus of the genus *Orthopoxvirus*. The virus causes skin eruptions with pustules and fever and may kill its victims in some cases.
smudge: A process during which plant material is set alight and then extinguished so that it smolders and produces smoke.
Solanaceous plants: Plants belonging to the family Solanaceae.
spadices: Fleshy or succulent flower spikes that are usually encased within a spathe or floral sheath.
sprue: A disease of tropical regions usually associated with diarrhea and poor absorption of nutrients.
sudorific: A substance or agent that causes or induces sweat.
susto: An illness widespread throughout Latin America. It literally means "fright illness" and is often associated with the fear of losing one's soul.
tachycardia: Rapid heartbeat.
taxon: A taxonomic category into which related organisms are classified. The plural is *taxa*.

tuberculosis: A serious pulmonary or lung infection caused by the bacterium *Mycobacterium tuberculosis*.

typhus: A bacterial disease (from *Rickettsia* species) that is transmitted by body lice and induces high fevers, delirium, and intense headaches.

Unani medicine: A traditional Islamic medical system developed by Avicenna.

vascular: Of or relating to a channel or system of vessels for the conveyance of body fluids, such as blood.

vernacular: Common name.

weed: A plant that grows outside its native range and tends to outcompete native flora.

WHO: World Health Organization. A specialized agency of the United Nations for health that was established on April 7, 1948.

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